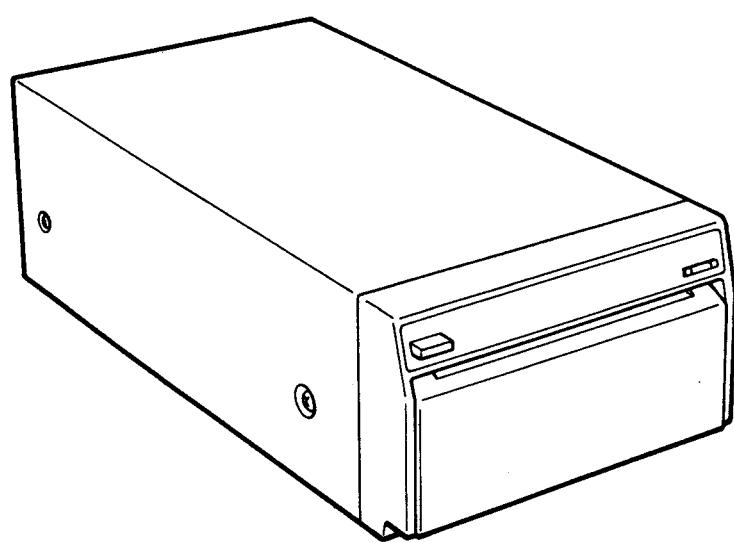


SONY.

VIDEO GRAPHIC PRINTER
UP-D860E

SERVICE MANUAL



SAFETY CHECK-OUT

After correcting the original service problem, perform the following safety checks before releasing the set to the customer:

1. Check the area of your repair for unsoldered or poorly-soldered connections. Check the entire board surface for solder splashes and bridges.
2. Check the interboard wiring to ensure that no wires are "pinched" or contact high-wattage resistors.
3. Look for unauthorized replacement parts, particularly transistors, that were installed during a previous repair. Point them out to the customer and recommend their replacement.
4. Look for parts which, though functioning, show obvious signs of deterioration. Point them out to the customer and recommend their replacement.
5. Check the B+ voltage to see it is at the values specified.

WARNING !!

AN ISOLATION TRANSFORMER SHOULD BE USED DURING ANY SERVICE TO AVOID POSSIBLE SHOCK HAZARD, BECAUSE OF LIVE CHASSIS.
THE CHASSIS OF THIS RECEIVER IS DIRECTLY CONNECTED TO THE AC POWER LINE.

SAFETY-RELATED COMPONENT WARNING !!

COMPONENTS IDENTIFIED BY SHADING AND MARK  ON THE SCHEMATIC DIAGRAMS, EXPLODED VIEWS AND IN THE PARTS LIST ARE CRITICAL TO SAFE OPERATION. REPLACE THESE COMPONENTS WITH SONY PARTS WHOSE PART NUMBERS APPEAR AS SHOWN IN THIS MANUAL OR IN SUPPLEMENTS PUBLISHED BY SONY.

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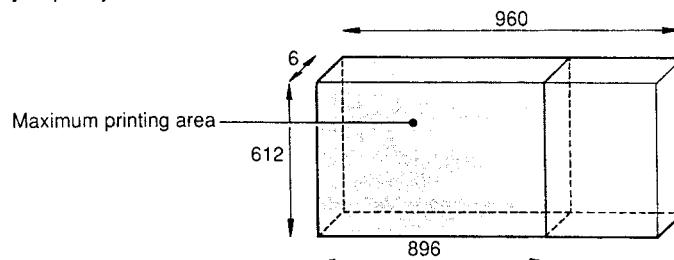
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SECTION 1

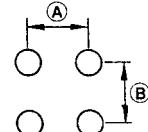
SPECIFICATIONS

Printer

Thermal head 896 dots
 Gradation 64 levels process (6 bit)
 Memory capacity



Printing size 100.3 (H) x 69 (V) mm
 Printing speed About 4.0 seconds/print
 Picture elements 896 (H) x 612 (V) dots
 Dots density H: 100.3/896 = 0.111 Ⓐ
 V: 69/612 = 0.112* Ⓑ
 * Pitch in vertical direction is
 $0.0812 \times N. (N = 6.7)$



Power requirements 220 to 240 V AC, 50/60 Hz
 Power consumption Max. 1.0 A
 Dimensions 154 x 106 x 300 mm (w/h/d)
 (6 1/8 x 4 1/4 x 11 7/8 inches)
 Weight About 3.6 kg (7 lb 15 oz)
 Supplied accessories
 Paper roll (UPP-110HD) (1)
 AC power cord (1)
 Head cleaning sheet (1)

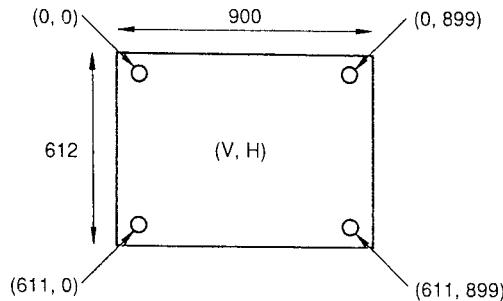
Design and specifications are subject to change without notice.

Interface

Connector 57 - 30360 amphenol
 Data transfer method 8 bit, parallel
 Synchronizing method STB pulse (external device)
 Logic level TTL level

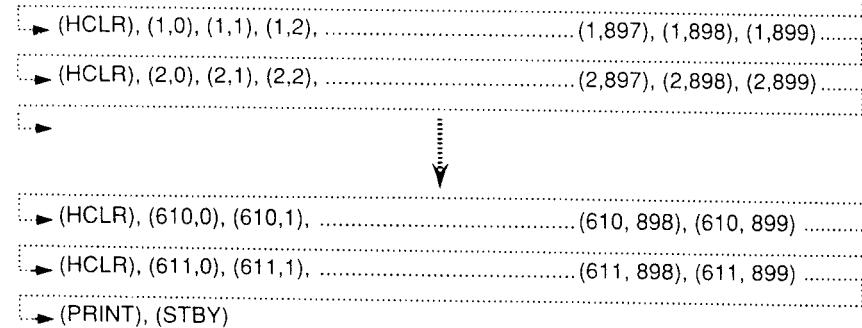
Specifications

Memory Address



Transfer sequence order

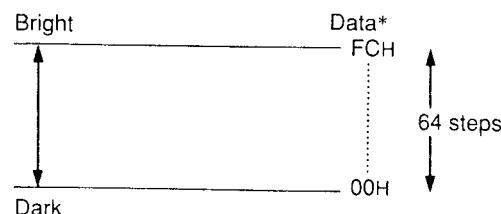
(STBY), (TRAN), (0,0), (0,1) (0,2), (0,897), (0,898), (0,899)



Command definition

	MSB	LSB
TRAN	0 0 0 0 0 0 1 1	=(03)H
HCLR	0 0 0 0 0 0 1 0	=(02)H
PRINT	0 0 0 0 0 0 0 1	=(01)H
STBY	0 0 0 0 0 0 0 0	=(00)H
DATA	* * * * * 0 0	
	Image data 6 bits	

Polarity of data (Luminance level)



* Polarity of data can be adjust on printer side (DIP switch No. 8).

Definition of signals

I (in): signal flow from computer to printer
 O (out): signal flow from printer to computer
 H: high level, L: low level

Pin No.	Signal	I/O	Definition
1	STB	I	Strobe pulse for reading data. Sampling data when changing from L to H.
2	DATA 1	I	Control data --- Transferring order is defined separately. DATA 1 :1 DATA 2 :1 TRAN : Starts trasnsferring 1 0 HCLR :H clear 0 1 PRINT : Starts printing 0 0 STBY :Standby
3	DATA 2	I	
4-9	DATA 3-8	I	Image data
10	ACK	O	Set to L. Received a data and is ready to receive next data.
11	BUSY	O	At H, cannot receive data. At L, can receive data.
12	PE	O	At H, indicate paper empty.
13	+5 V (SELECT)	O	Pull up to +5 V at 3.3 kΩ. Indicates printer is turned on and connected.
14	AUTO FEED	I	At L, feed the paper. At H, do not feed the paper.
15	NC		
16-17	GND		
18	NC		
19-30	GND		
31	INIT	I	At L, printer becomes initial mode and stops printing.
32	ERROR	O	At L, error occurred; heat up, paper empty, door open
33	GND		
34	DOOR OPEN	O	At L, printer door is open.
35	+5 V	O	Regularly pulling up to +5 V at 3.3 kΩ.
36	NC		

SECTION 2

GENERAL

2-1. OVERVIEW

This section is extracted
from instruction manual

The UP-D860E is a black and white digital graphic printer to print computer images on thermal paper of 110 mm width.

Clear, consistent print quality

- High definition, 8.9 dots/mm printing using a thermal head with high-speed drive IC
- 64 graduations of black and white

Fast printing

- You can make a single print-out in about 4.0 seconds.

Output modes

- You can make print-outs starting either from the bottom or top of the image by setting the DIRECTION DIP switch.
- You can make print-out of either 1:1 or 6:7 pixel by setting the LINE PITCH DIP switch.

Alarm buzzer

The alarm buzzer function prevents you from making any misoperation.

Loading paper easy and quickly

You can load paper just by opening the paper lid with the OPEN/CLOSE button and placing the paper roll.

2-2. PRECAUTIONS

On safety

Check the operating voltage before operation.

Operate the unit only with a power source specified in "Specifications".

Stop operation immediately if any liquid or solid object falls into the cabinet.
Unplug the unit and have it checked by qualified personnel.

Unplug the unit from the wall outlet if you will not be using it for a long time.
Disconnect the cord by grasping the plug. Never pull the cord itself.

Do not disassemble the cabinet.
Refer servicing to qualified personnel only.

Do not touch the cutting blade of the printer.

Connect the power plug of the printer to the wall outlet having protective earth terminal.

The safety earth should be properly established.

On operation

Do not turn the power off while the printer is printing.

Otherwise, the thermal head may be damaged.

On printer carriage

Do not carry and move the printer when the paper roll is placed in the printer.
If you do, this may cause trouble.

On installation

Provide adequate air circulation to prevent heat build-up.

Do not place the unit on surfaces such as rugs, blankets, etc., or near materials such as curtains and draperies.

Do not install the printer near heat sources. Avoid locations near radiators or air ducts, or place subject to direct sunlight or excessive dust, humidity.

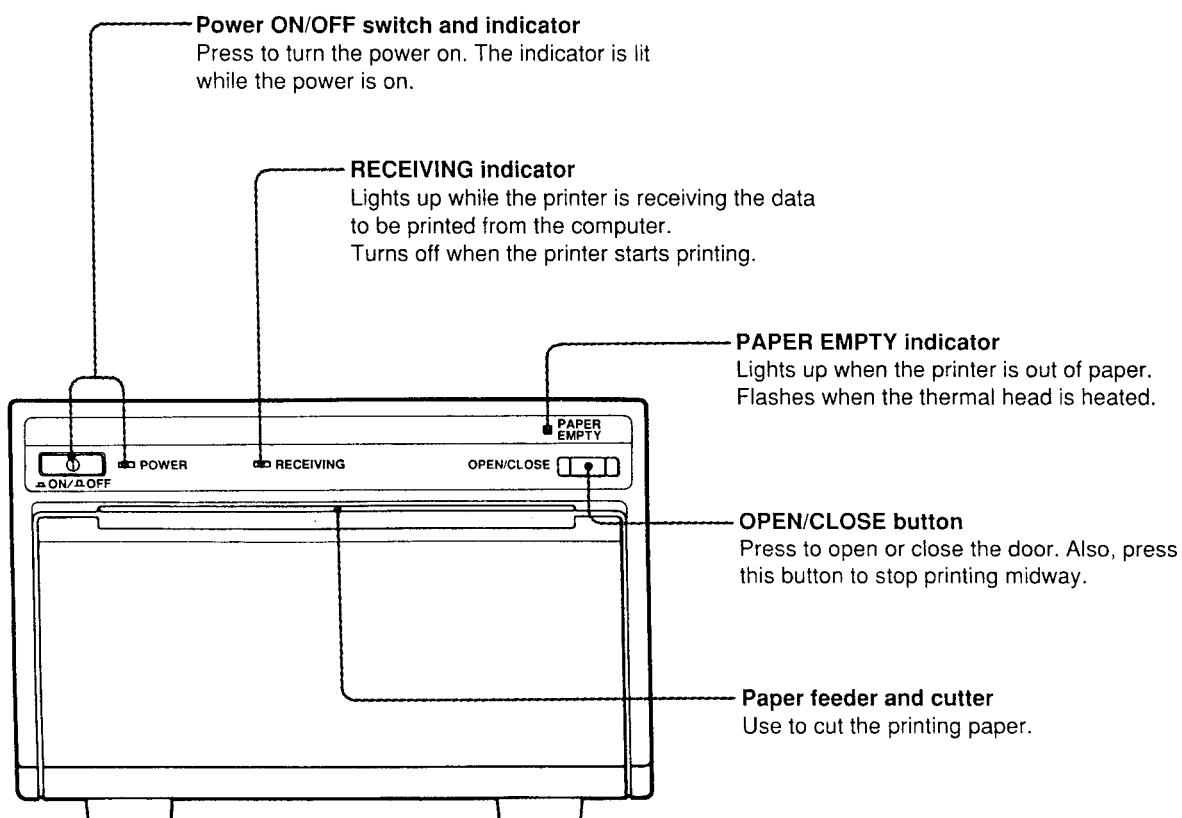
Place the printer on a level, stable surface during operation.

Do not expose the printer to mechanical shock or vibration.

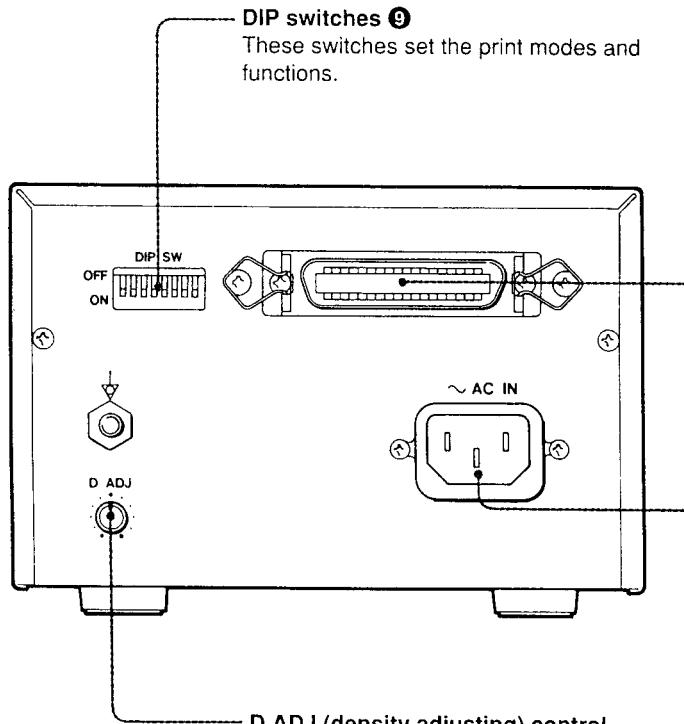
2-3. LOCATION AND FUNCTION OF PARTS AND CONTROLS

Refer to the pages indicated in the circles for details.

Front Panel



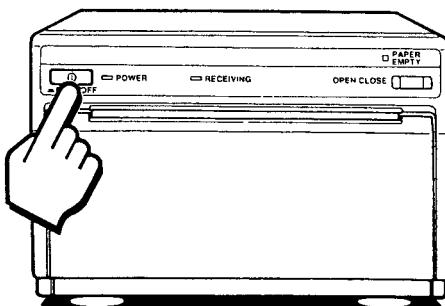
Rear Panel



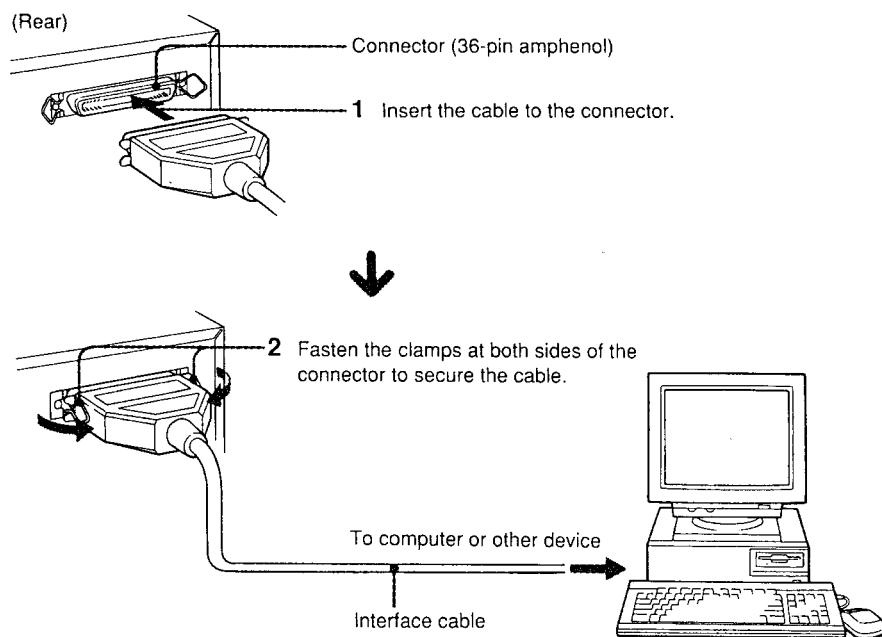
2-4. CONNECTING THE PRINTER

Connect the interface cable of your computer to the UP-D860E digital graphic printer and the supplied AC power cord to the printer and then to a wall outlet. The type of interface cable differs with your computer. Before attempting to connect the printer, also refer to the operating instructions of your computer and/or other peripherals to which the printer is to be connected.

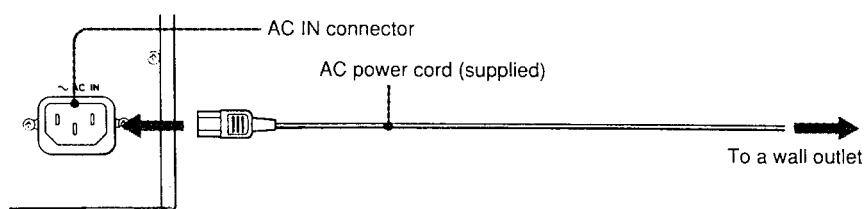
1 Turn off the power of the printer.



2 Turn off the power of the computer and connect a suitable cable to the printer connector (centronics) of the printer.

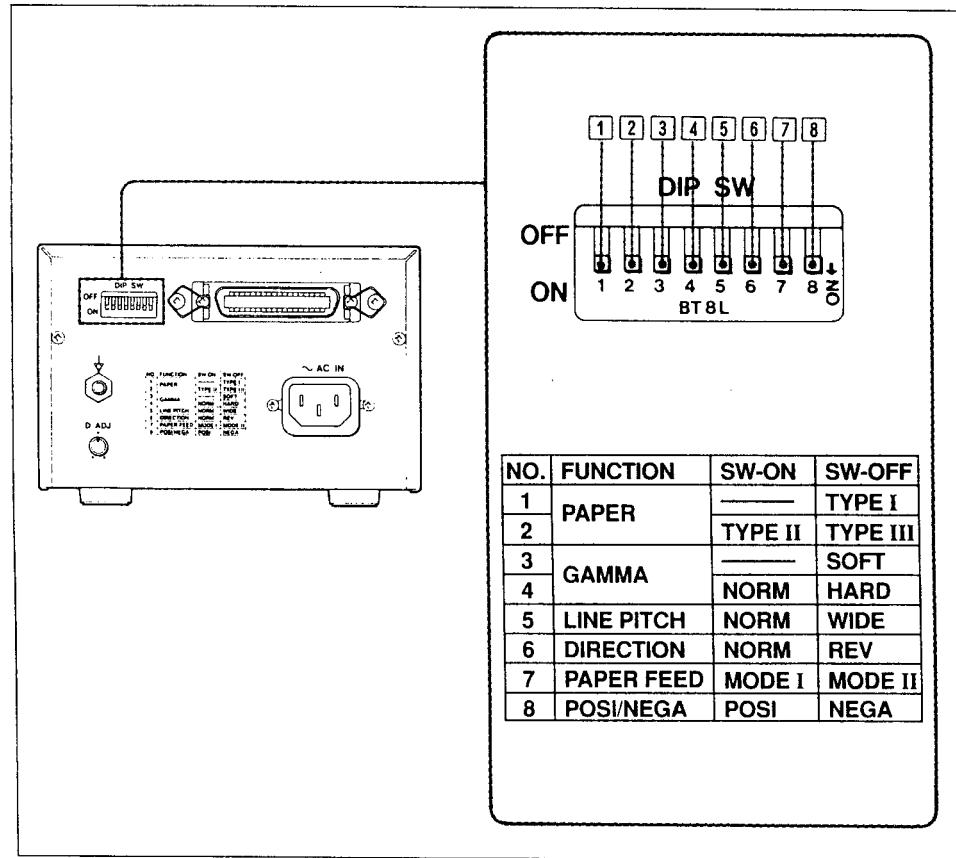


3 Connect the AC power cord to the AC IN connector on the rear of the printer and then connect the cord to a wall outlet.



2-5. SETTING THE DIP SWITCHES

Set the DIP switches according to the required print mode. Before setting the DIP switches, turn the power off. Change the settings using a small pointed tool such as a small screwdriver. All DIP switches are factory-set to ON.



1 2 PAPER switches

Set the switches according to the type of printing paper being used. For details of the paper, see page 11.

Printing paper	PAPER switch position	
	1	2
UPP-110HD	ON (—)	ON (TYPE II)
UPP-110S	OFF (TYPE I)	Do not care.

TYPE I paper mode is selected irrespective of the position of the [2] PAPER switch, however leave the switch at the factory-set position (ON).

3 4 GAMMA switches

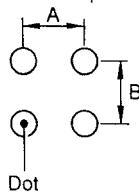
These switches change the print mode to that for high density printing paper. These switches are effective when the TYPE II paper is used.

Print mode	GAMMA switch position	
	3	4
Soft graduation	OFF (SOFT)	Do not care.
Standard	ON (—)	ON (NORM)
Hard graduation	ON (—)	OFF (HARD)

Setting the DIP Switches

5 LINE PITCH switch

Use this switch to set the line pitch according to the graphic display specifications of the computer.

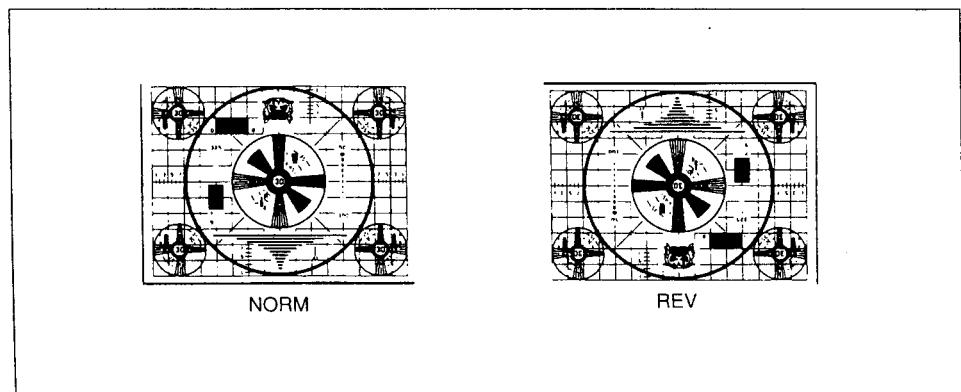


When the A:B is 1:1, set to ON (NORM).
When the A:B is 6:7, set to OFF (WIDE).

6 DIRECTION switch

Use this switch to select whether the top or bottom of the screen is to be printed from.

To start printing from the bottom, set to ON (NORM).
To start printing from the top, set to OFF (REV).



7 PAPER FEED switch

When the computer has the feeding control (AUTO FEED) in the centronics, set to ON (MODE I).

When the computer does not have the feeding control in the centronics:
set to ON (MODE I) to save paper by feeding only a short length of paper after printing a picture;
set to OFF (MODE II) to feed out extra blank paper once a picture has been printed.

8 POSI/NEGA switch

Use this switch to change between positive and negative print-out.

Set to ON (POSI) for a positive print-out.

Set to OFF (NEGA) for a negative print-out.

2-6. LOADING PAPER

On the Paper

Type of paper

The use of paper other than Sony paper may result in reduced printer performance and poor print quality.

Use only UPP-110 series paper.

Printer	Type of paper
TYPE I (Normal)	UPP-110S
TYPE II (High Density)	UPP-110HD

Storing paper

Do not leave unused paper in hot or humid locations.

Do not leave unused paper in direct sunlight or other bright locations for extended periods.

Store unused or printed paper in a cool, dark place (below 30°C or 86°F)
We recommend that you store printed paper in a polypropylene pouch.

Do not allow any volatile organic solvent or vinyl chloride to come into with the printed paper.

Alcohol, plastic tape or film will fade the print-out. To attach printed paper to another piece of paper, use double-sided adhesive tape, or water-based or solid glue.

Do not stack printed paper or under a freshly-developed diazo copy sheet.
Otherwise, the printout may become discolored in black.

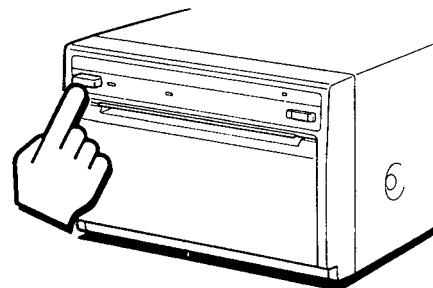
Loading Paper

Before loading paper

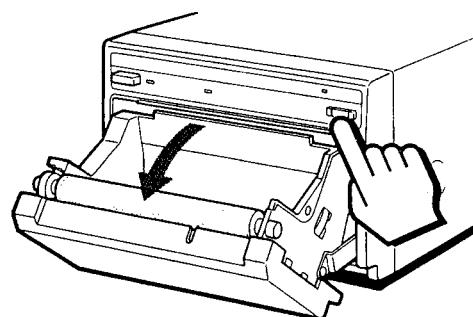
Do not fold the paper or touch the printing surface. Dust on the printing surface will result in poor print quality. When loading the paper roll, take up any slack by pulling out and cutting off the first 15 to 20 cm (6 to 7 $\frac{7}{8}$ inches) paper. Otherwise, the print quality will not be satisfactory and the printer may malfunction.

Loading paper

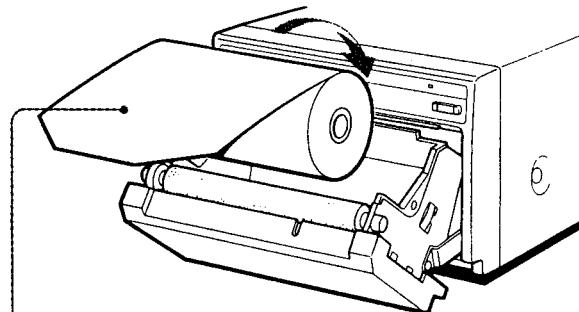
- 1 Press the POWER ON/OFF switch to turn the printer on.



- 2 Press the OPEN/CLOSE button to open the paper lid.

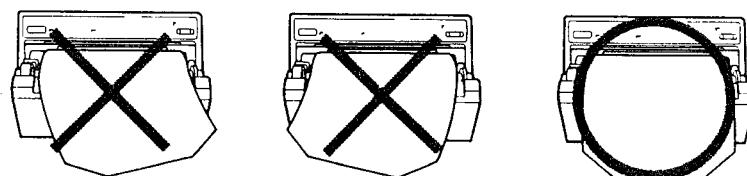
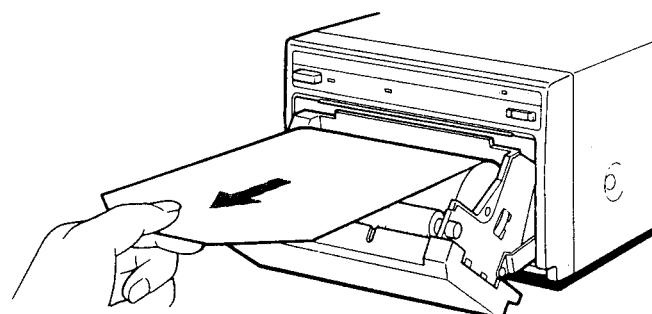


3 Place the paper roll in the printer.

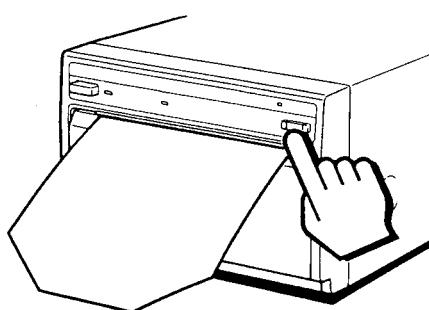


Place the paper with the thermo-sensitive side (printing side) up.

4 Pull out the first 15 to 20 cm of the paper to remove any slack in the roll.



5 Press the OPEN/CLOSE button to close the paper lid.
You can also close the paper lid simply by pushing it.



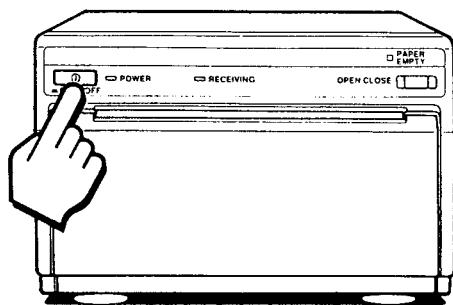
2-7. PRINTING A PICTURE

Before making print-outs

- Be sure that the DIP switch settings are correct (see page 9).
- Be sure that all connections are correct.
- Be sure that the paper roll is loaded properly (see page 12).

Printing a picture

- 1 Press the POWER ON/OFF switch to turn the printer on.**
The power indicator lights.



- 2 Make sure that the PAPER EMPTY indicator is not lit.**
If lit, load paper.
- 3 Send the image data from the computer to the printer and enter the PRINT commands.**
Image data is transmitted to the printer through the quasi centronics interface.

Stopping printing midway

Press the OPEN/CLOSE button while printing . The printer stops printing.
When the centronics has the INIT signal, input the "Low" pulse to the printer to stop printing.

If the data transmission is canceled midway
If you cancel the data transmission after the data transmission has started, the printer stays in data receive mode. Input the TRAN STBY command (see page 18) again.

2-8. MAINTENANCE

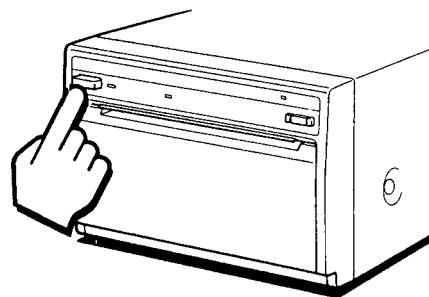
Cleaning the cabinet

Do not use strong solvents to clean the printer.
Thinner or abrasive cleansers will damage the cabinet.

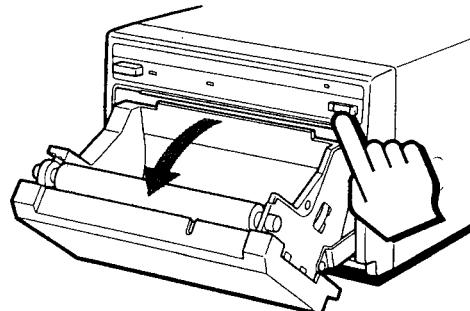
Cleaning the thermal head

If the print-out is dirty or white stripes appear on the print-outs, clean the thermal head using the supplied cleaning sheet.

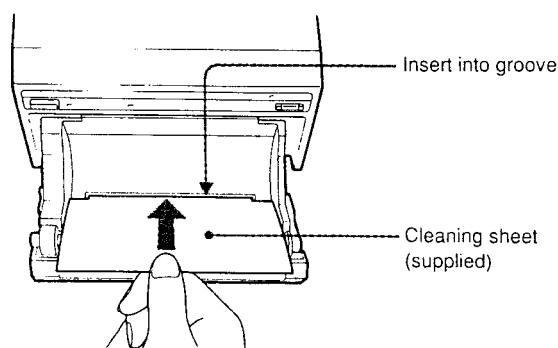
- 1 Press the POWER ON/OFF switch to turn on the printer.



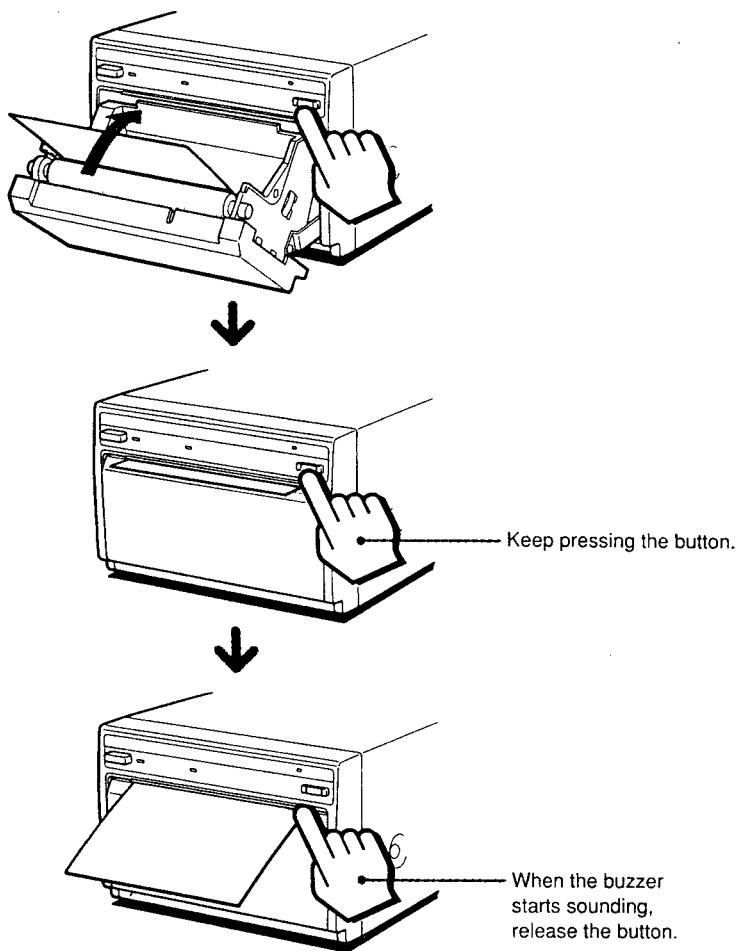
- 2 Press the OPEN/CLOSE button to open the paper lid.



- 3 Insert the cleaning sheet, with the black surface facing down, into the groove in the paper lid.



4 Press the OPEN/CLOSE button and keep it pressed.
The paper lid closes and the printer starts cleaning the head.
Keep pressing the OPEN/CLOSE button until the buzzer starts sounding and the printer starts ejecting the cleaning sheet.
(The buzzer sounds throughout the cleaning process.)



5 Remove the cleaning sheet.

Note

Clean the head only when necessary. If you clean the head too often, it may cause malfunctions.

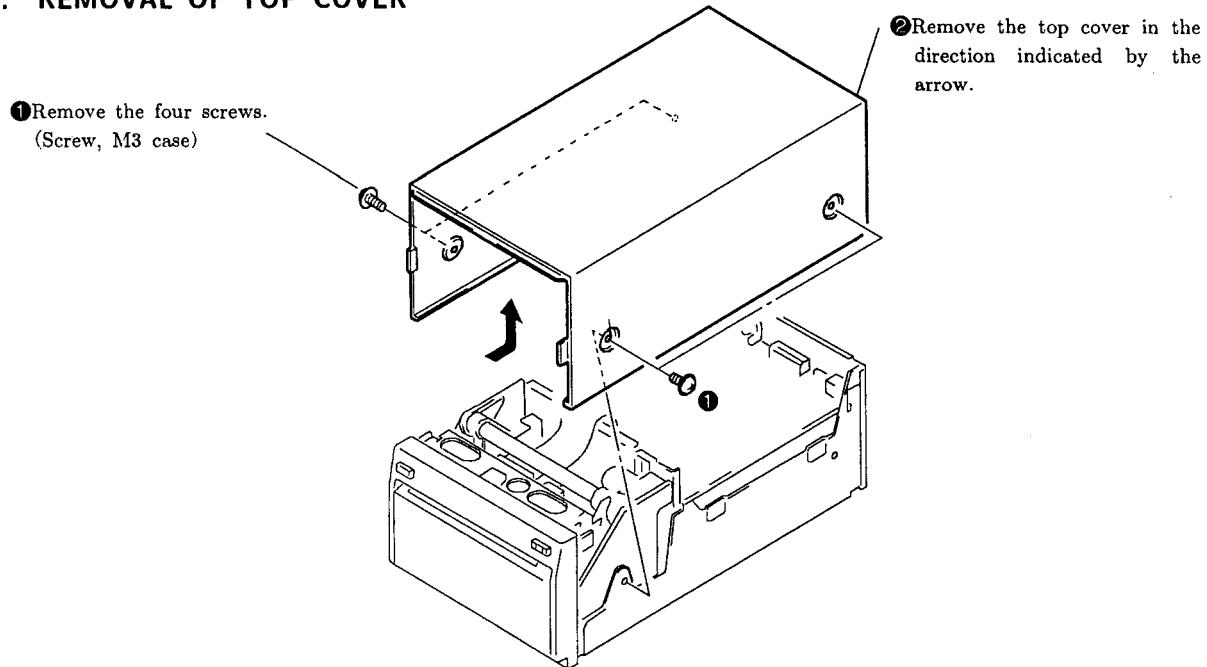
2-9. TROUBLESHOOTING

Symptom	Cause/remedy Refer also to the pages indicated by ●.
White specks on first few print-outs.	When printing with a newly inserted roll of paper, dust on the surface of the paper may cause white specks on the print-outs. → Feed the paper by pressing the OPEN/CLOSE button until clean paper appears.
Printing does not start when the images have been transmitted from the computer.	<ul style="list-style-type: none"> • Paper is not fed. <ul style="list-style-type: none"> → Is the paper slack? → Is the power turned on? → Are all connections correct? (page ⑧) • When the alarm buzzer sounds: <ul style="list-style-type: none"> → Has the thermal head overheated? → Is the paper loaded correctly? • Paper is fed, but printing does not start. <ul style="list-style-type: none"> → Is the paper loaded with the thermo-sensitive side up?
Paper jam	<ul style="list-style-type: none"> • Open the paper lid by pressing the OPEN/CLOSE button, then remove the jammed paper by slowly pulling it. • Is there any condensation within the unit? <ul style="list-style-type: none"> → Moving the unit suddenly from a cold place to a warm place often results in condensation forming. In the event of condensation forming, remove the paper, turn off the power and leave the unit for about one to two hours.
Print-out is dirty.	<ul style="list-style-type: none"> Is the thermal head dirty? → Clean the thermal head with the supplied head cleaning sheet (page ⑯).
The printer stops printing when it prints continuously black pictures.	<p>This is likely to occur when the printer prints continuously 15 or more black pictures. In such a case, the buzzer sounds. → This is because that the protective circuit works against heat build-up of the thermal head. Stop printing for a while.</p>

SECTION 3

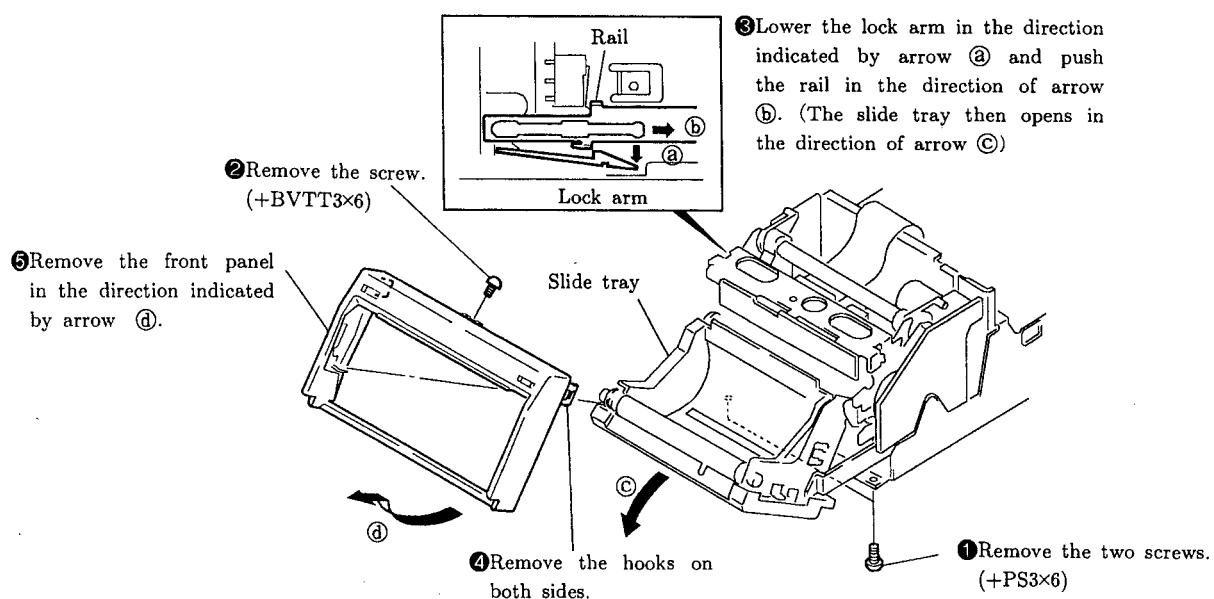
DISASSEMBLY

3-1. REMOVAL OF TOP COVER



3-2. REMOVAL OF FRONT PANEL

※ To remove the slide tray without turning on the power, pull out the slide tray while pushing up the Lever at the bottom of the set backward.



3-3. REMOVAL OF MA-15 BOARD

① Remove the nine connectors.

{ CN51, CN101, CN201, CN202, CN301,
CN303, CN304, CN305, CN306 }

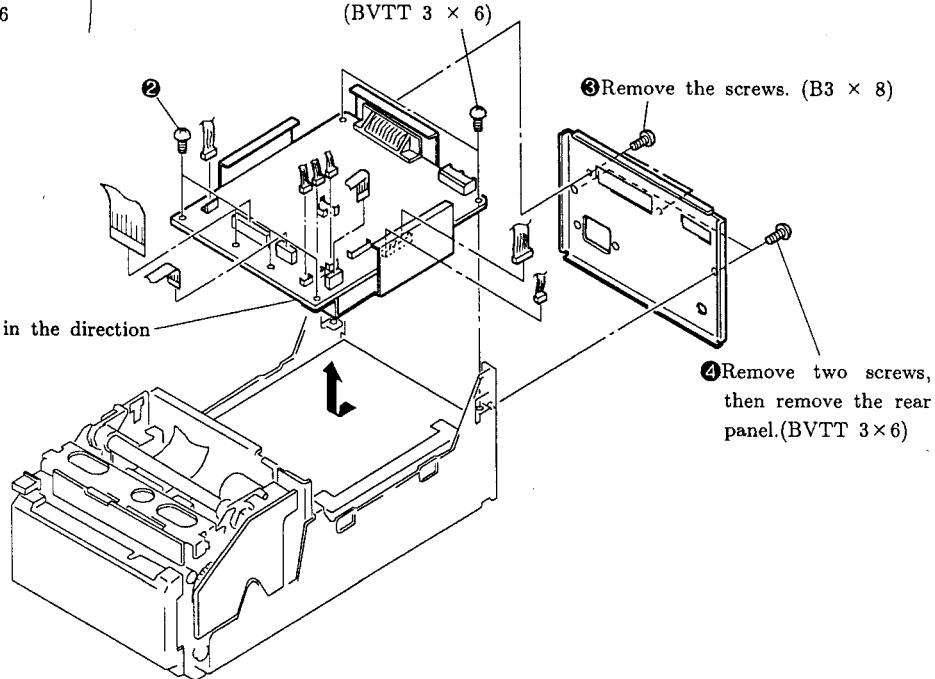
② Remove the six screws.

(BVTT 3 × 6)

③ Remove the screws. (B3 × 8)

④ Remove two screws,
then remove the rear
panel.(BVTT 3 × 6)

⑤ Remove the MA-15 board in the direction
indicated by the arrow.

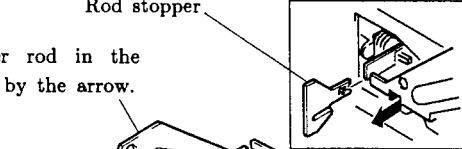


3-4. REMOVAL OF MECHANISM BLOCK

① Remove the rod stopper.

Rod stopper

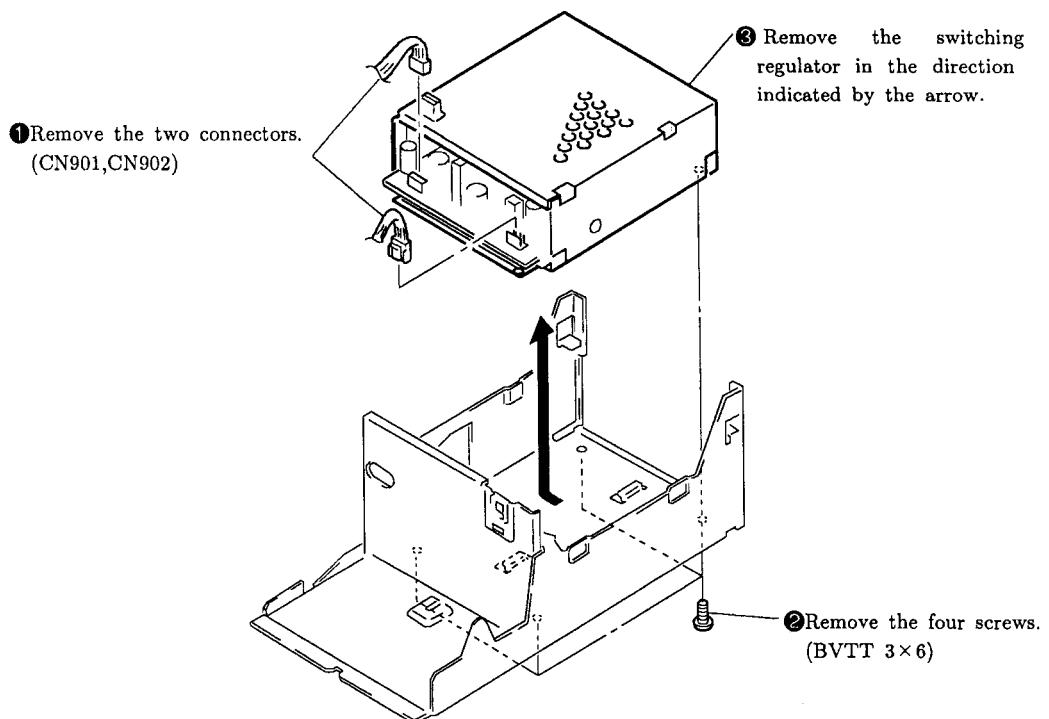
② Remove the power rod in the
direction indicated by the arrow.



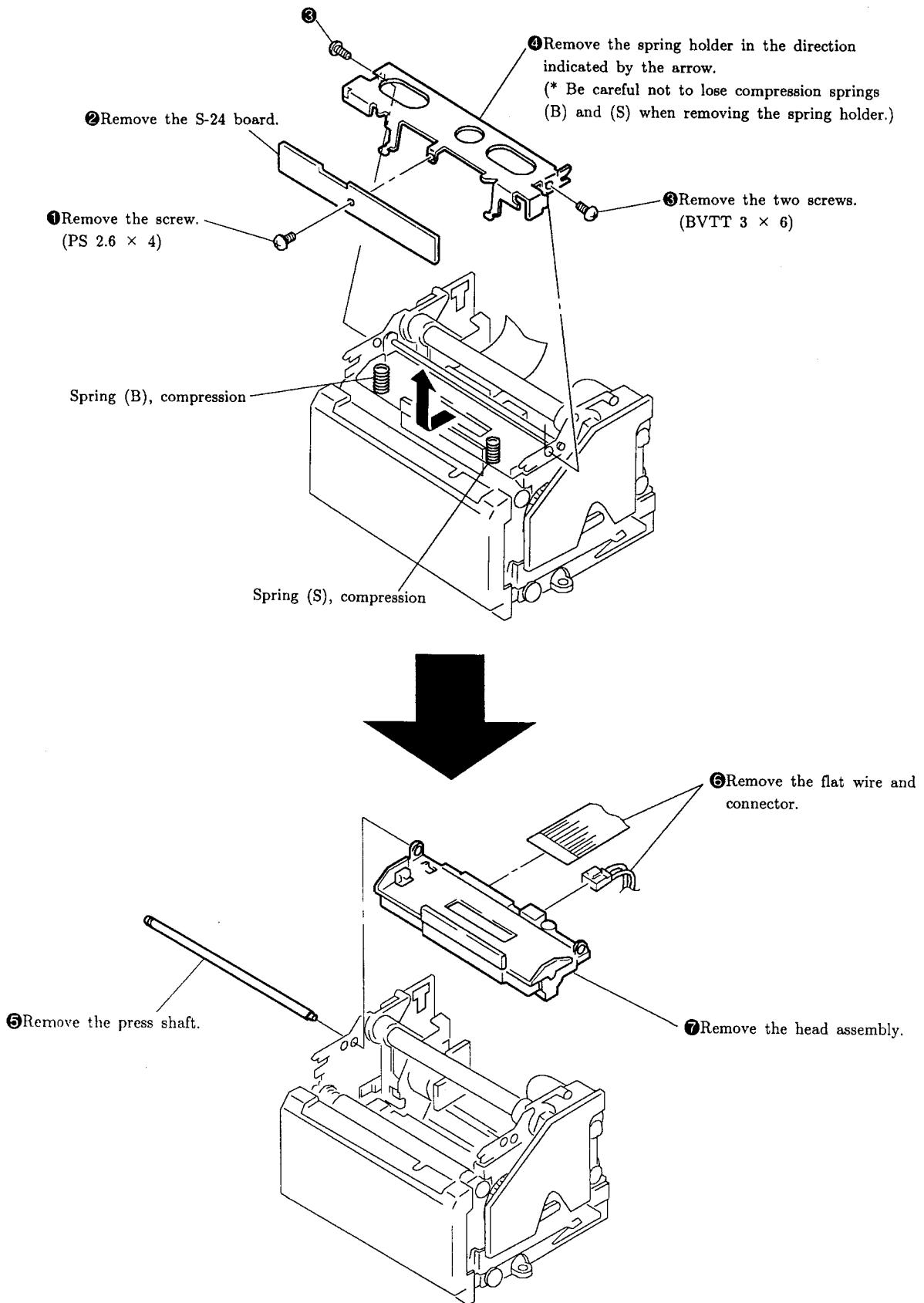
③ Remove the connector.

④ Remove the mechanism block.

3-5. REMOVAL OF REAR PANEL AND SWITCHING REGULATOR



3-6. REMOVAL OF THERMAL HEAD



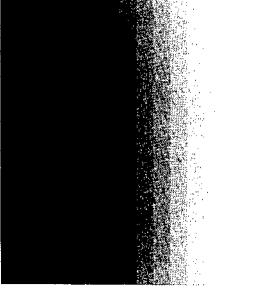
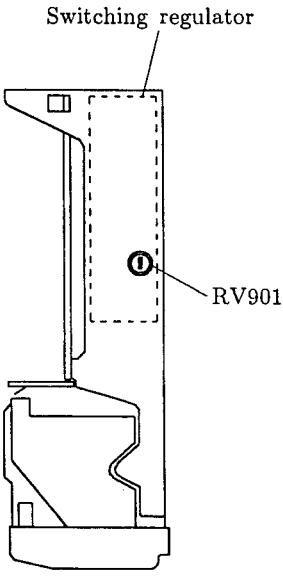
SECTION 4

ADJUSTMENTS

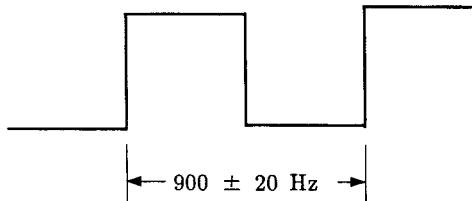
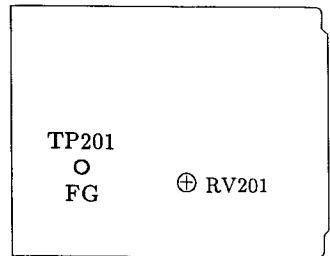
Measuring Equipment Required

1. Oscilloscope
2. Frequency counter
3. Digital multimeter

4-1. HEAD VOLTAGE ADJUSTMENT

Conditions for adjustment	Specification	Adjustment
<ul style="list-style-type: none"> · Remove the top cover and turn on the POWER switch. · For printing-out, press the TEST PRINT button on the MA-15 board. · Set DIP switches 1 through 8 to ON (lower position). · Use the UPP-110HD paper. · Set the D.ADJ variable resistor (RV 903) of a switching regulator to the center position. 	 <p>Fig.1</p> <p>Adjust RV901 to make the 17-step gradation signal smooth as shown in Fig.1.</p>	<p>● RV901</p> 

4-2. MOTOR SPEED ADJUSTMENT

Conditions for adjustment	Specification	Adjustment
<ul style="list-style-type: none"> · Remove the top cover and press the TEST PRINT button to measure the waveform at TP201(FG). · Set DIP switches 1 through 8 to ON (lower position). · Use the UPP-110HD paper. <p>Note : Do not adjust while a print blank strip is fed.</p>	 <p>TP201</p>	<p>● RV201/C-3 (MA-15)</p> 

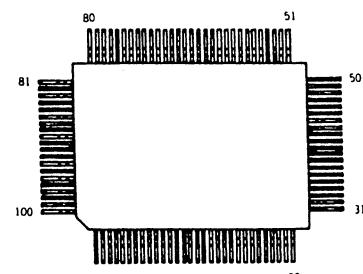
SECTION 5

DIAGRAMS

5-1. SEMICONDUCTORS

CXD8284Q (SONY)

- TOP VIEW -

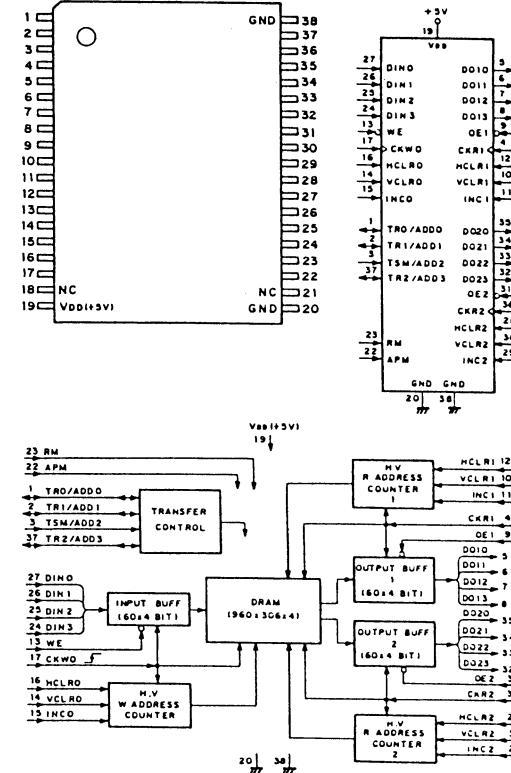


No.	I/O	Name	No.	I/O	Name	No.	I/O	Name	No.	I/O	Name
1	-	VCC	26	O	SPCCK	51	I	AD0	76	O	PWMD00
2	I	SRT0	27	O	COPING	52	I	BD1	77	O	PWMD01
3	I	SRT1	28	O	EXTV	53	I	BD0	78	O	PWMD02
4	I	SRT2	29	O	INTV	54	I	AD3	79	O	PWMD03
5	I	SRT3	30	O	MCK16	55	I	AD2	80	O	PWMD04
6	I	RMTEST	31	O	MCK1K	56	I	BD3	81	O	PWMD05
7	O	MONID0	32	-	GND	57	I	BD2	82	O	PWMD06
8	O	MONID1	33	I	STB	58	I	AD5	83	-	VCC
9	O	MONID2	34	I	DRIN	59	I	AD4	84	O	PWMD07
10	O	MONID3	35	I	COPY	60	I	BD5	85	O	PWMD08
11	O	MONID4	36	I	FETCH	61	I	BD4	86	O	PWMD09
12	O	MONID5	37	I	RSTLD	62	-	VCC	87	O	PWMD10
13	-	GND	38	I	CPSTOP	63	O	HCLR0	88	O	PWMD11
14	I	FRTEST	39	-	VCC	64	O	INC0	89	O	PWMD12
15	I	TEXTH	40	O	DITH1	65	O	VCLR0	90	O	PWMD13
16	I	TEXTV	41	O	DITH2	66	O	WE0	91	-	GND
17	I	TODDEV	42	O	ODDEVN	67	O	HCLR1	92	O	THCK
18	I	TINTV	43	I	CSYNC	68	O	INC1	93	O	DROUT
19	I	TMODE	44	O	DKCOUT	69	O	VCLR1	94	O	STBOUT
20	I	FG	45	O	EXTH	70	O	DCKR1	95	-	VCC
21	I	RESET	46	-	GND	71	O	HCLR2	96	I	M152N
22	I	NEGPOS	47	I	MCLK	72	O	INC2	97	I	ERR
23	I	SCK	48	I	DKIN	73	O	VCLR2	98	I	M1221
24	I	SI	49	I	HDO	74	O	DCKR2	99	I	M3411
25	-	VCC	50	I	AD1	75	-	GND	100	I	SNROFF

CXK1206M (SONY) FLAT PACKAGE

C-MOS VIDEO FIELD MEMORY (960-COLUMNx306-ROWx4-BIT)

- TOP VIEW -



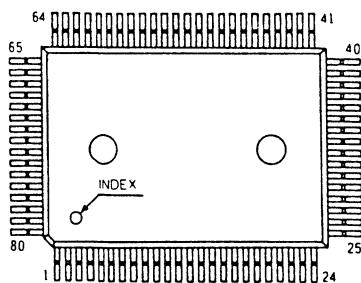
PIN	SIGNAL	DESCRIPTION
1	TR0/ADD0	W PORT 0 TRANSFER SYNC I/O, ADDRESS 0 INPUT
2	TR1/ADD1	R PORT 1 TRANSFER SYNC I/O, ADDRESS 1 INPUT
3	TR2/ADD2	R PORT 2 TRANSFER SYNC I/O, ADDRESS 2 INPUT
4	CKR1	R PORT 1 SHIFT SIGNAL INPUT
5	D010	R PORT 0 DATA 0 OUTPUT
6	D011	R PORT 1 DATA 1 OUTPUT
7	D012	R PORT 1 DATA 2 OUTPUT
8	D013	R PORT 1 DATA 3 OUTPUT
9	OE1	R PORT 1 OUTPUT ENABLE INPUT
10	VCLR1	R PORT 1 VERTICAL CLEAR INPUT
11	INC1	R PORT 1 LINE INCREMENT INPUT
12	HCLR1	R PORT 1 HORIZONTAL CLEAR INPUT
13	WE	W PORT 0 WRITE ENABLE INPUT
14	VCLR0	W PORT 0 VERTICAL CLEAR INPUT
15	INC0	W PORT 0 LINE INCREMENT INPUT
16	HCLR0	W PORT 0 HORIZONTAL CLEAR INPUT
17	CKW0	W PORT 0 SHIFT SIGNAL INPUT
18	NC	(no connection)
19	VDD	+5V INPUT
20	GND	GND
21	NC	(no connection)
22	APM	ADDRESS PRESET MODE INPUT
23	RMM	RECURSIVE MODE ENABLE INPUT
24	DIN3	W PORT 0 DATA 3 INPUT
25	DIN2	W PORT 0 DATA 2 INPUT
26	DIN1	W PORT 0 DATA 1 INPUT
27	DIN0	W PORT 0 DATA 0 INPUT
28	HCLR2	R PORT 2 HORIZONTAL CLEAR INPUT
29	INC2	R PORT 2 LINE INCREMENT INPUT
30	VCLR2	R PORT 2 VERTICAL CLEAR INPUT
31	OE2	R PORT 2 OUTPUT ENABLE INPUT
32	D023	R PORT 2 DATA 3 OUTPUT
33	D022	R PORT 2 DATA 2 OUTPUT
34	D021	R PORT 2 DATA 1 OUTPUT
35	D020	R PORT 2 DATA 0 OUTPUT
36	CKR2	R PORT 2 SHIFT SIGNAL INPUT
37	TR2/ADD3	R PORT 2 TRANSFER SYNC I/O, ADDRESS 3 INPUT
38	GND	GND

MODE SELECTION			
CONTROL	INPUTS	TS, TR/ADD	MODE
RM	APM	TSM	TR 0-2 ADD 0-3
0	0	0	OUT PUT - NON RECURSIVE MODE, TRANSFER SYNCHRONOUS MODE OUTPUT
0	0	1	IN-PUT - NON RECURSIVE MODE, TRANSFER SYNCHRONOUS MODE INPUT
0	1	-	IN-PUT - NON RECURSIVE MODE, ADDRESS PRESET MODE
1	0	0	OUT PUT - RECURSIVE MODE, TRANSFER SYNCHRONOUS MODE OUTPUT
1	0	1	IN-PUT - RECURSIVE MODE, TRANSFER SYNCHRONOUS MODE INPUT

0:LOW LEVEL 1:HIGH LEVEL

CXP80P116Q-2-203 (SONY)

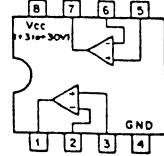
- TOP VIEW -



LM358PS (TI) FLAT PACKAGE

DUAL OPERATIONAL AMPLIFIERS

- TOP VIEW -

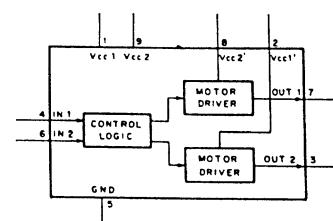
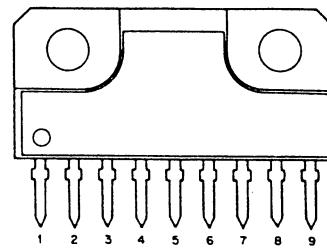


M54543L (MITSUBISHI)

M54543L (MITSUBISHI)

BI-DIRECTINAL MOTOR DRIVER

- SIDE VIEW -



IN	OUT	MODE
1 2 1 2		
0 0 Z Z		NO OPERATION
1 0 1 0		ROTATION
0 1 0 1		REVERSE ROTATION
1 1 0 0		BRAKE

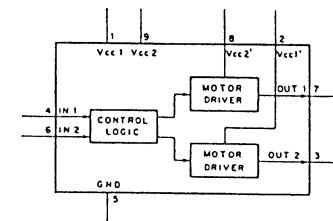
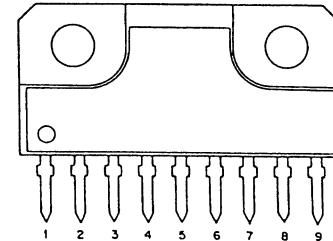
0: LOW LEVEL
1: HIGH LEVEL
Z: HIGH IMPEDANCE

M51970M (MITSUBISHI)

M54544AL (MITSUBISHI)

BI-DIRECTINAL MOTOR DRIVER

- SIDE VIEW -



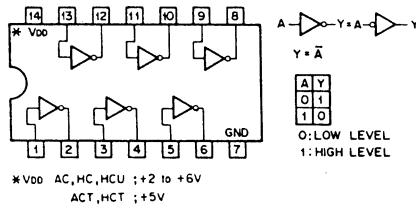
IN	OUT	MODE
1 2 1 2		
0 0 Z Z		NO OPERATION
1 0 1 0		ROTATION
0 1 0 1		REVERSE ROTATION
1 1 0 0		BRAKE

0: LOW LEVEL
1: HIGH LEVEL
Z: HIGH IMPEDANCE

SN74HCU04NS (TI) FLAT PACKAGE

C-MOS INVERTER

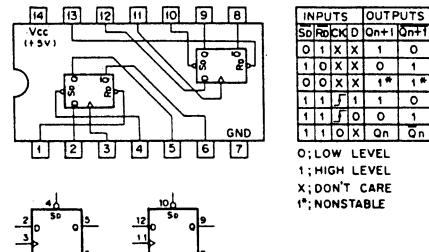
- TOP VIEW -



SN74LS74ANS (TI) FLAT PACKAGE

TTL D-TYPE FLIP FLOP WITH DIRECT SET/RESET

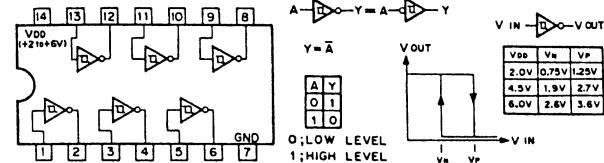
- TOP VIEW -



SN74HC14NS (TI) FLAT PACKAGE

C-MOS SCHMITT TRIGGER INVERTER

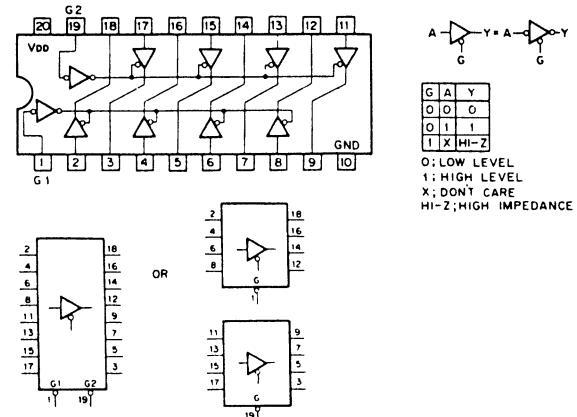
- TOP VIEW -



SN74HC244NS (TI) (V_{DD} = +2 to +6V) FLAT PACKAGE

C-MOS BUS BUFFER WITH 3-STATE OUTPUTS

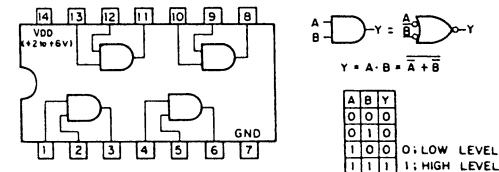
- TOP VIEW -



SN74HC08NS (TI) FLAT PACKAGE

C-MOS 2-INPUT AND GATE

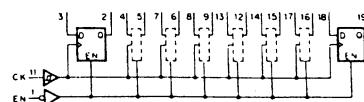
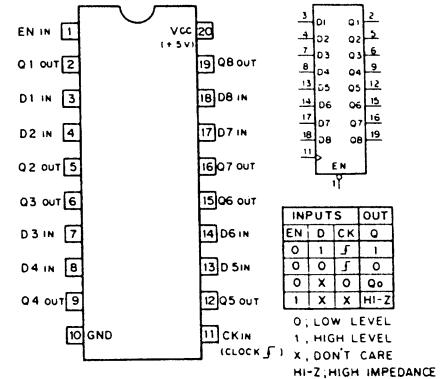
- TOP VIEW -



SN74LS374N (TI)

TTL 3-STATE OUTPUTS OCTAL D-TYPE FLIP-FLOP

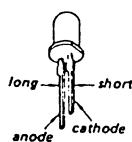
- TOP VIEW -



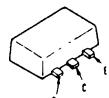
2SA1162
2SC2712-G
DTA124EK
DTC124EK



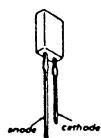
GL520



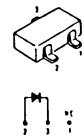
2SD999



TLG211-GH
TLO211
TLY211



RD3.6M-B2
RDS 6M-B2
RD9.1M-B2
1SS184



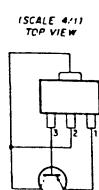
PT501-A



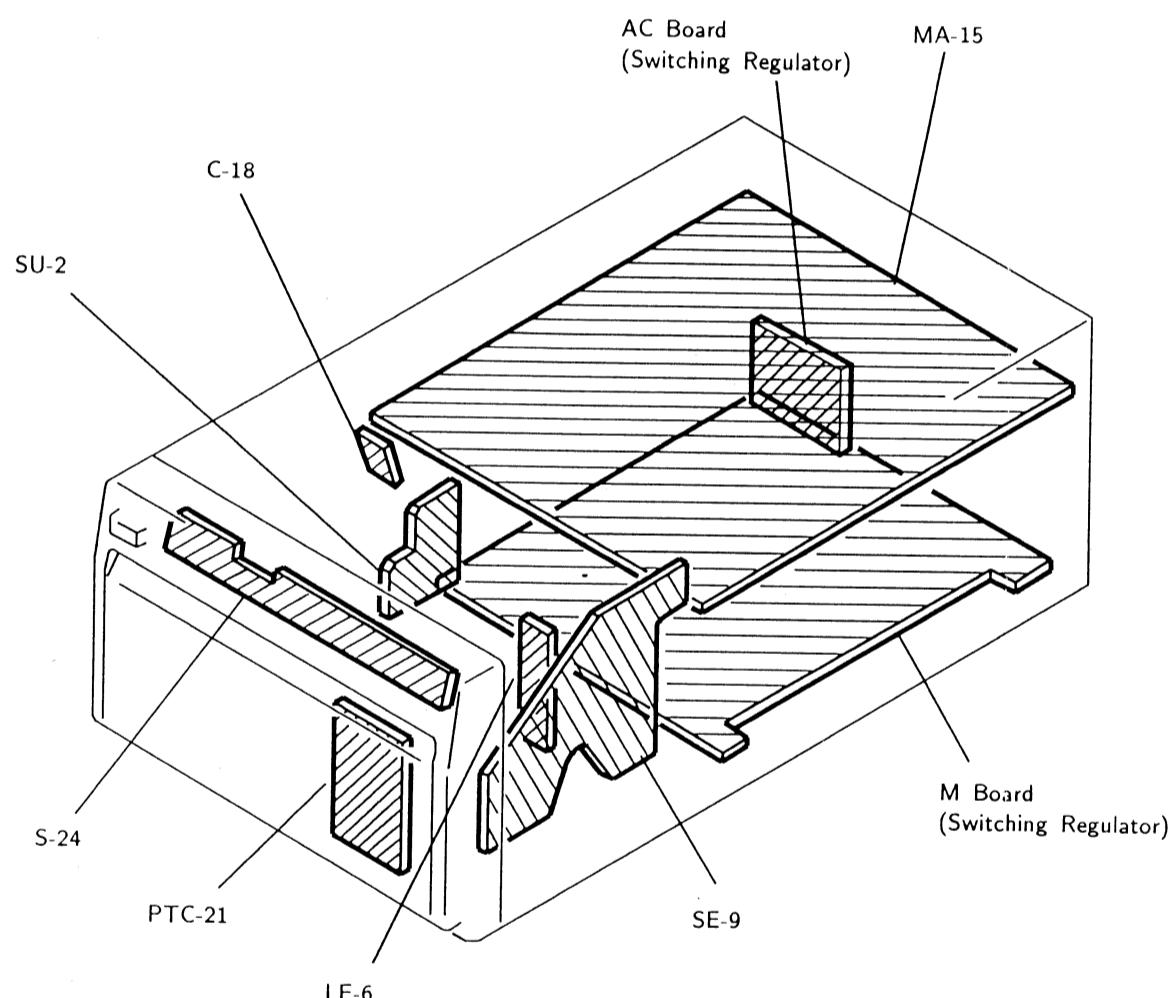
GL420
GP1551
PT421F



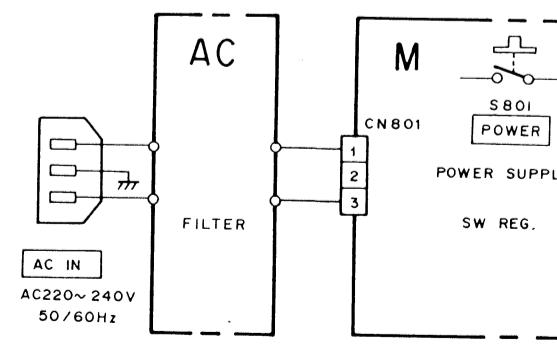
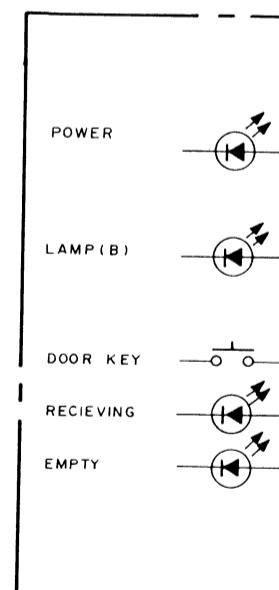
2SB798-DL



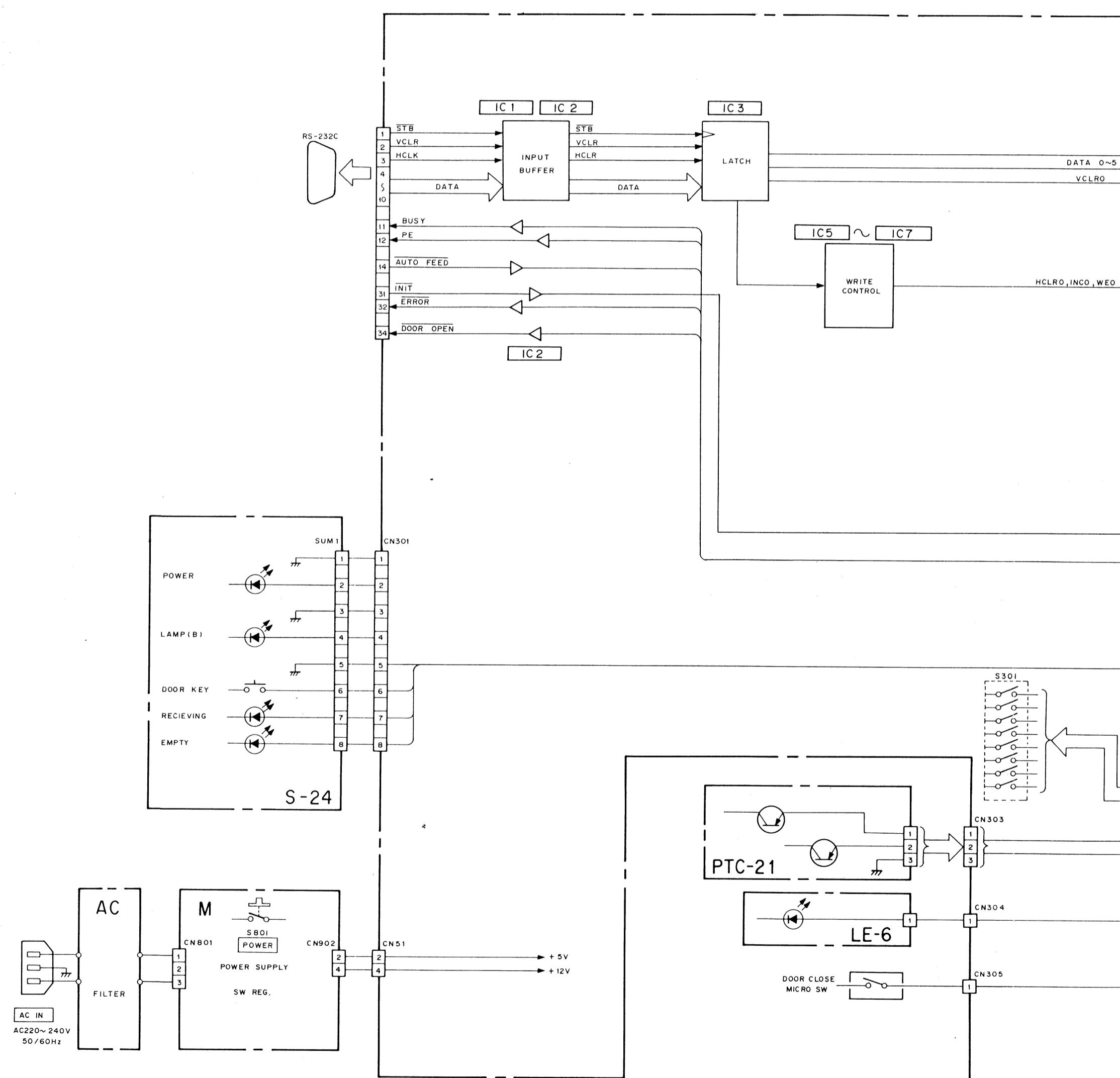
5-2. CIRCUIT BOARDS LOCATION

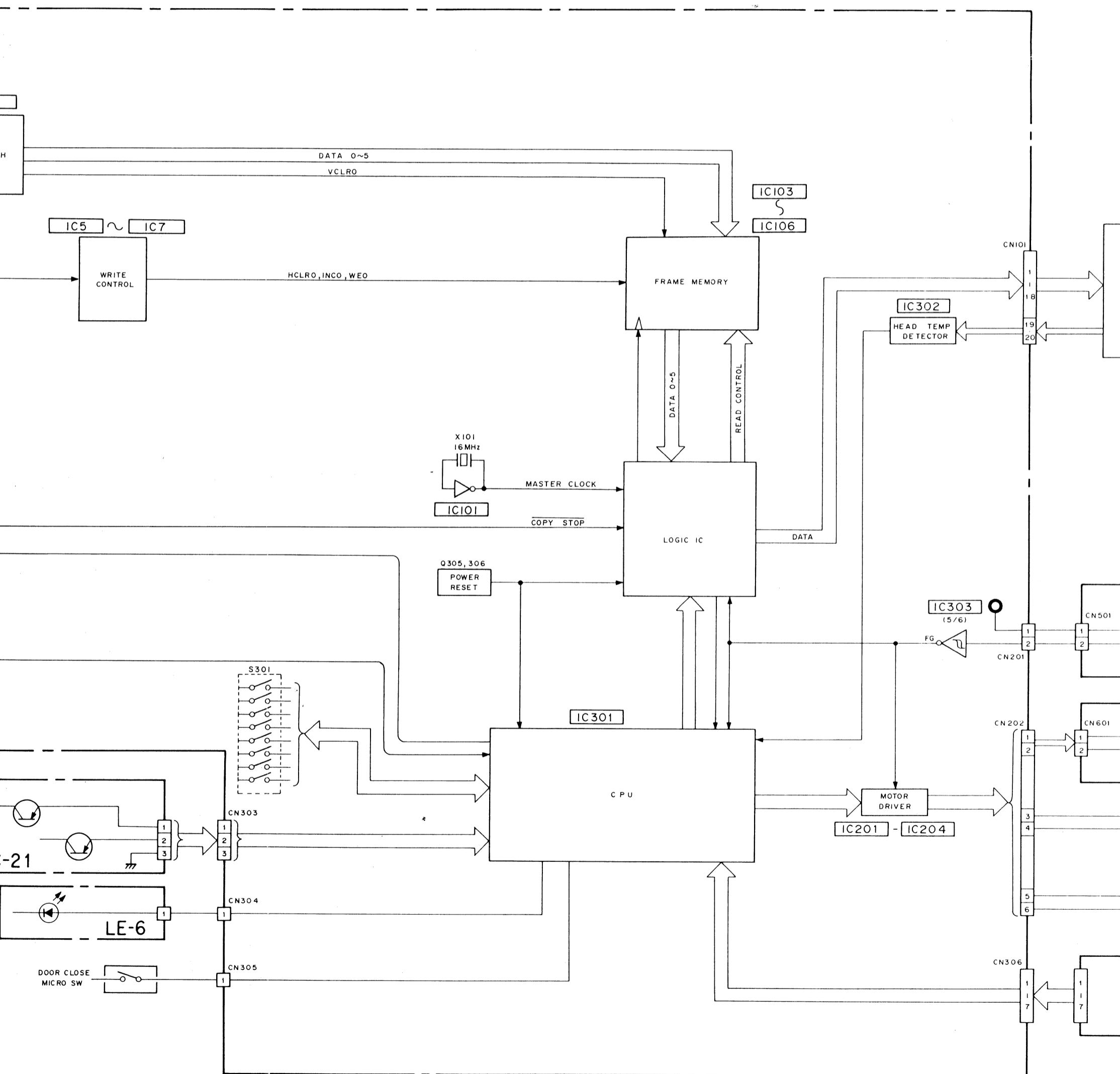


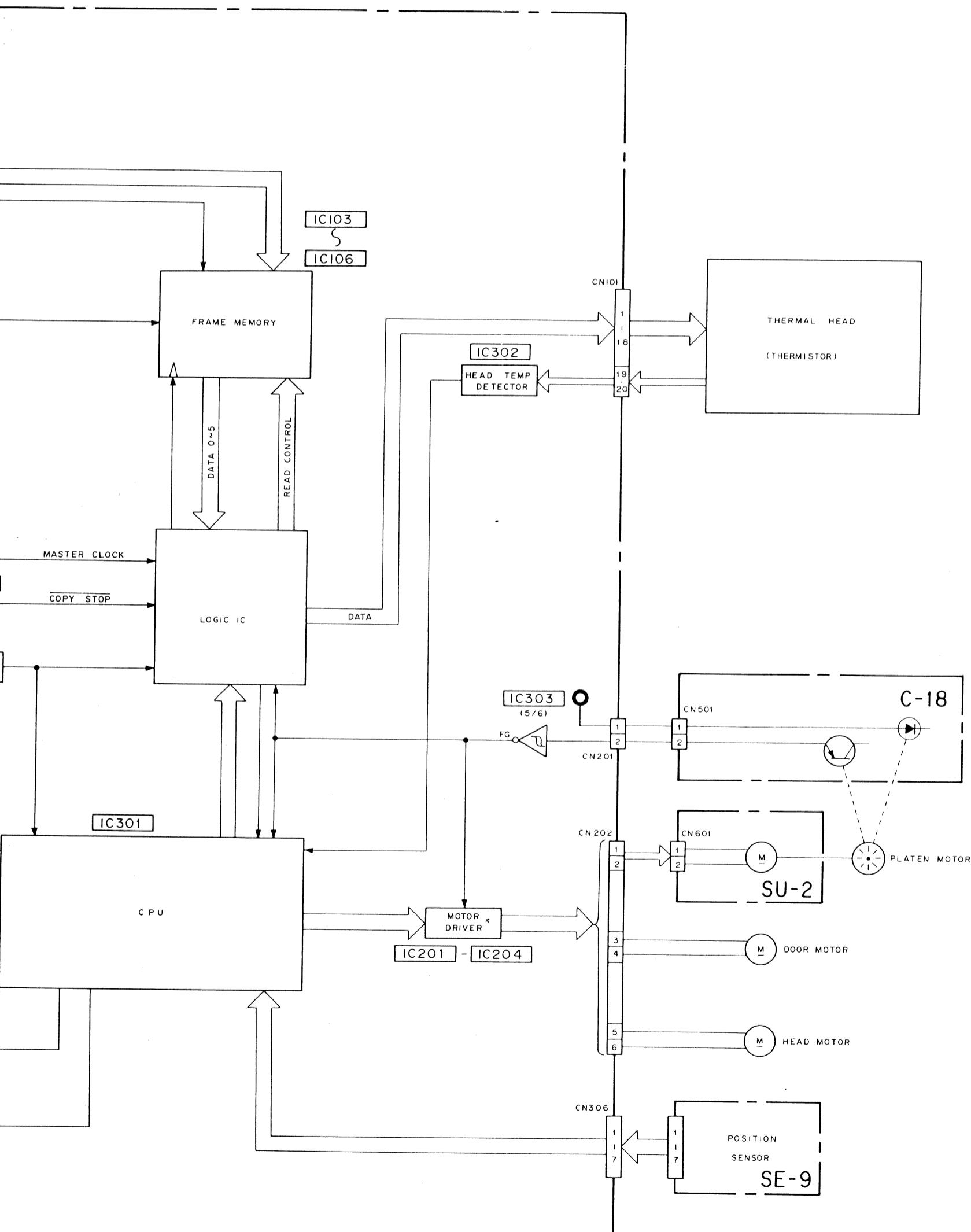
5-3. BLOCK DIAGRAM



5-3. BLOCK DIAGRAM







5-4. PRINTED WIRING BOARDS AND SCHEMATIC DIAGRAMS

1 2 3 4 5 6 7 8 9 10 11

A

THIS NOTE IS COMMON FOR PRINTED WIRING
BOARDS AND SCHEMATIC DIAGRAMS.

(In addition to this, the necessary note is printed in each
block.)

B

• For schematic diagrams.

• Caution when replacing chip parts.

New parts must be attached after removal of chip.
Be careful not to heat the minute side of tantalum capacitor,
because it is damaged by the heat.

C

• All resistors are in ohms, 1/10W unless otherwise noted.
kΩ : 1000Ω, MΩ : 1000kΩ.• All capacitors are in μF unless otherwise noted. pF: μμF.
50V or less are not indicated except for electrolytics and
tantalums.

D

• All variable and adjustable resistors have characteristic curve B,
unless otherwise noted.

• : nonflammable resistor.

• : fusible resistor.

• : panel designation.

• : adjustment for repair.

• — : B+ Line.

E

• Voltages are dc between ground and measurement points.

• Readings are taken with a color-bar signal playback.

• Readings are taken with a digital multimeter (DC10MΩ).

• Voltage variations may be noted due to normal production
tolerances.

F

Note: The components identified by shading and mark are critical for safety. Replace only with part number specified.

G

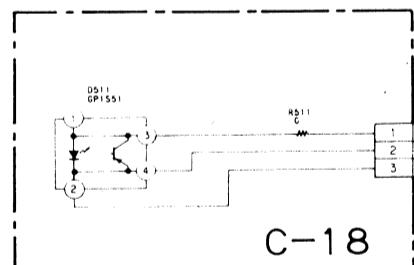
For printed wiring boards.

• : soldering side

• : component side

H

I



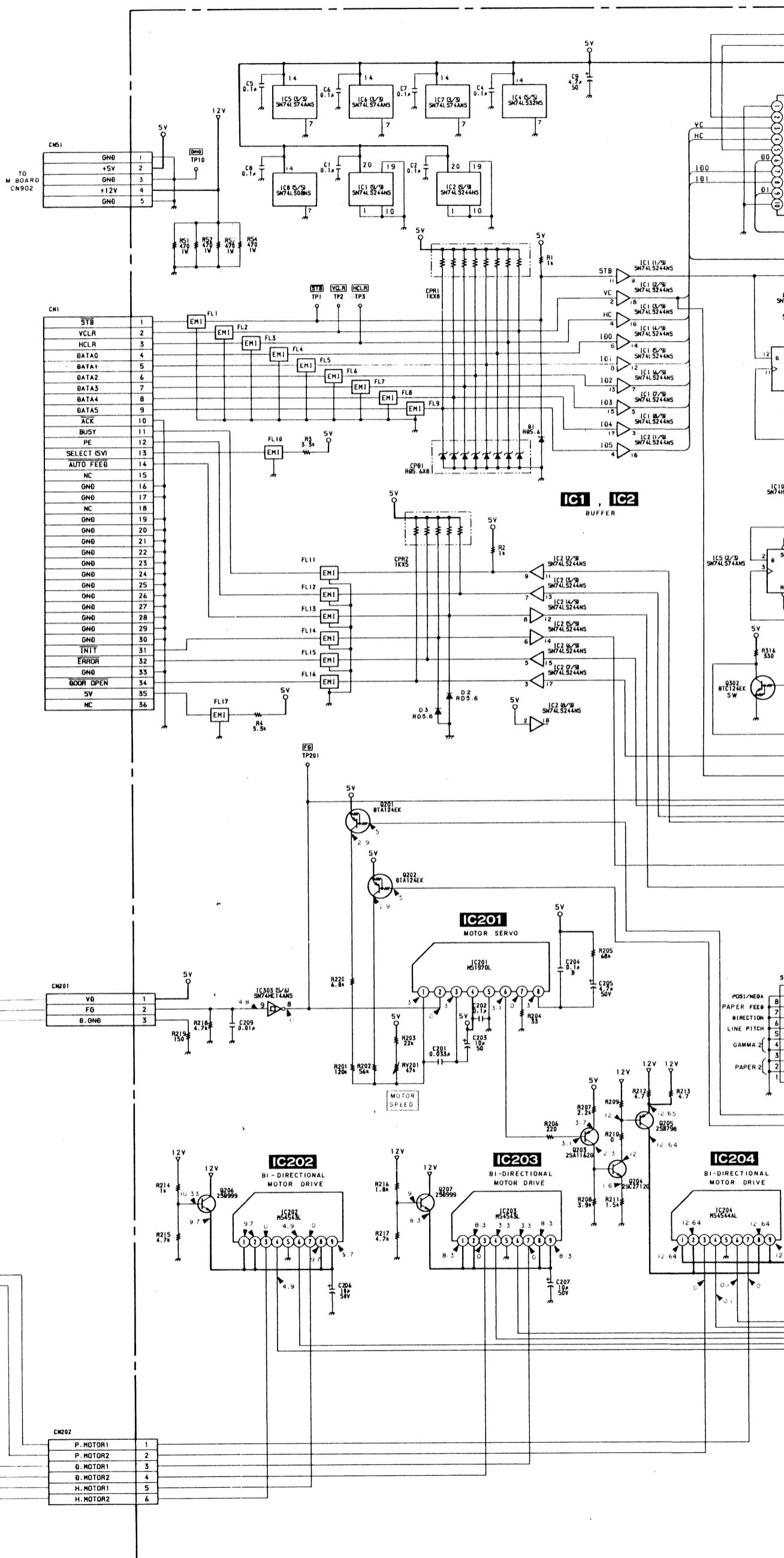
J

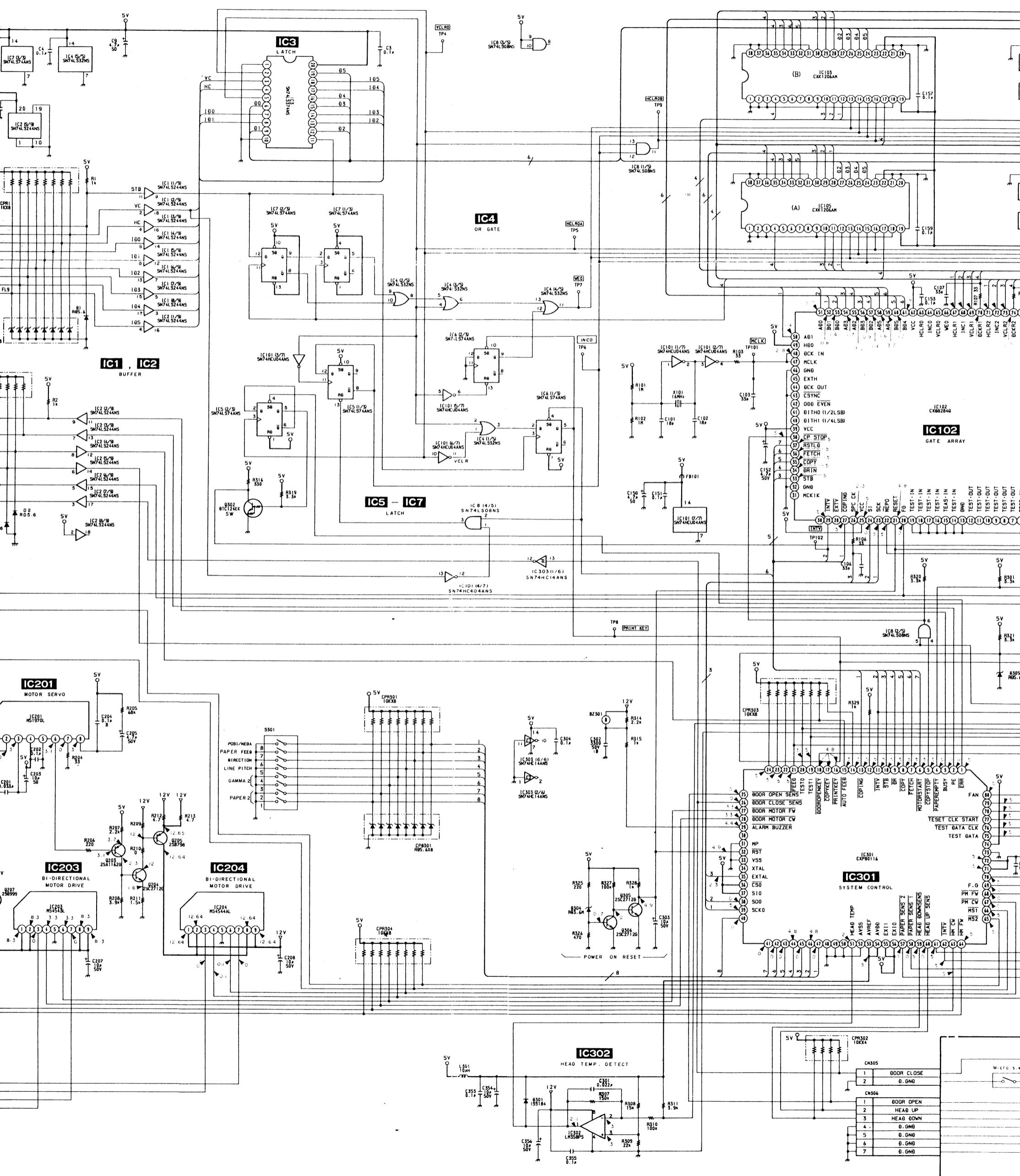
K

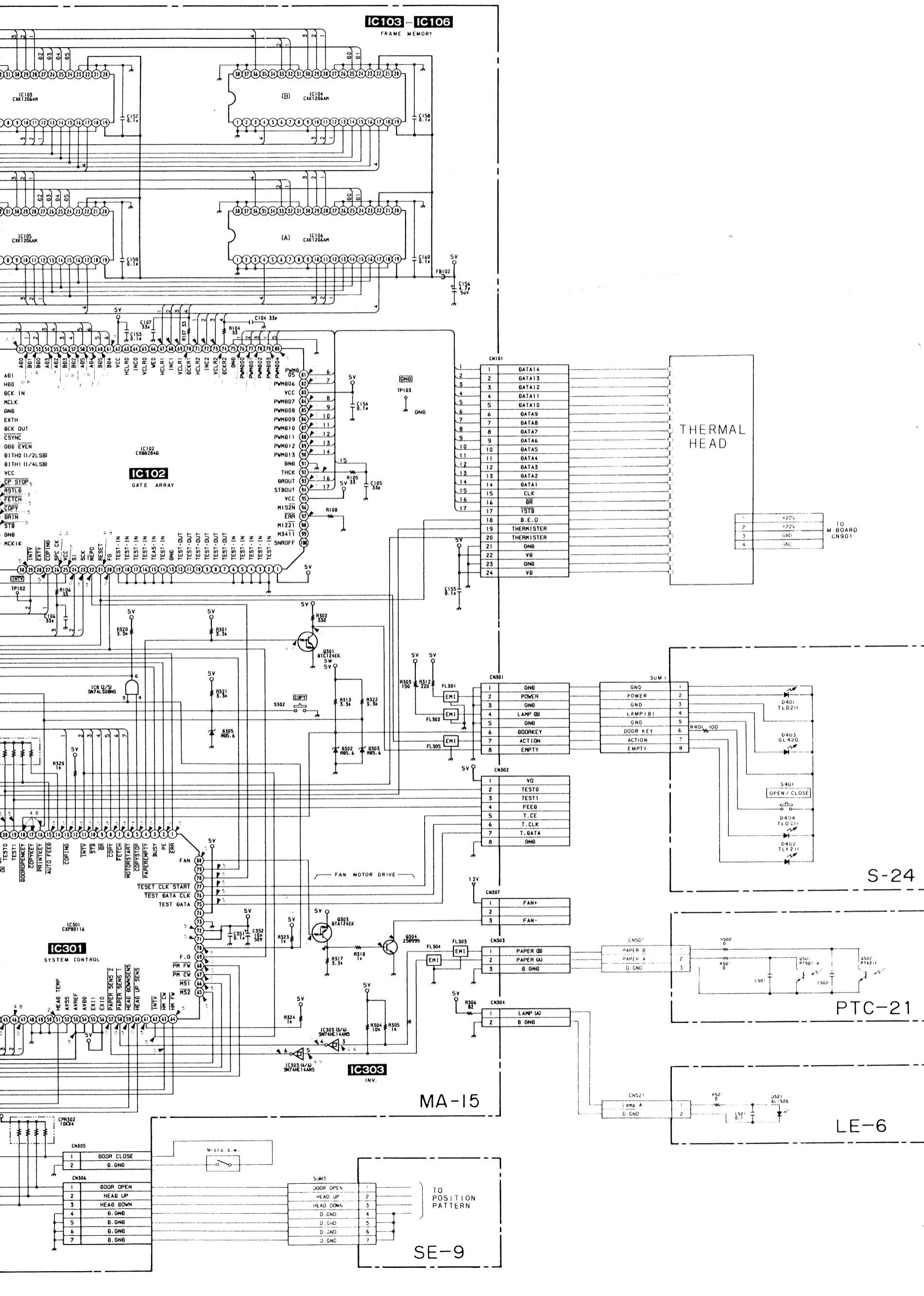
L

M

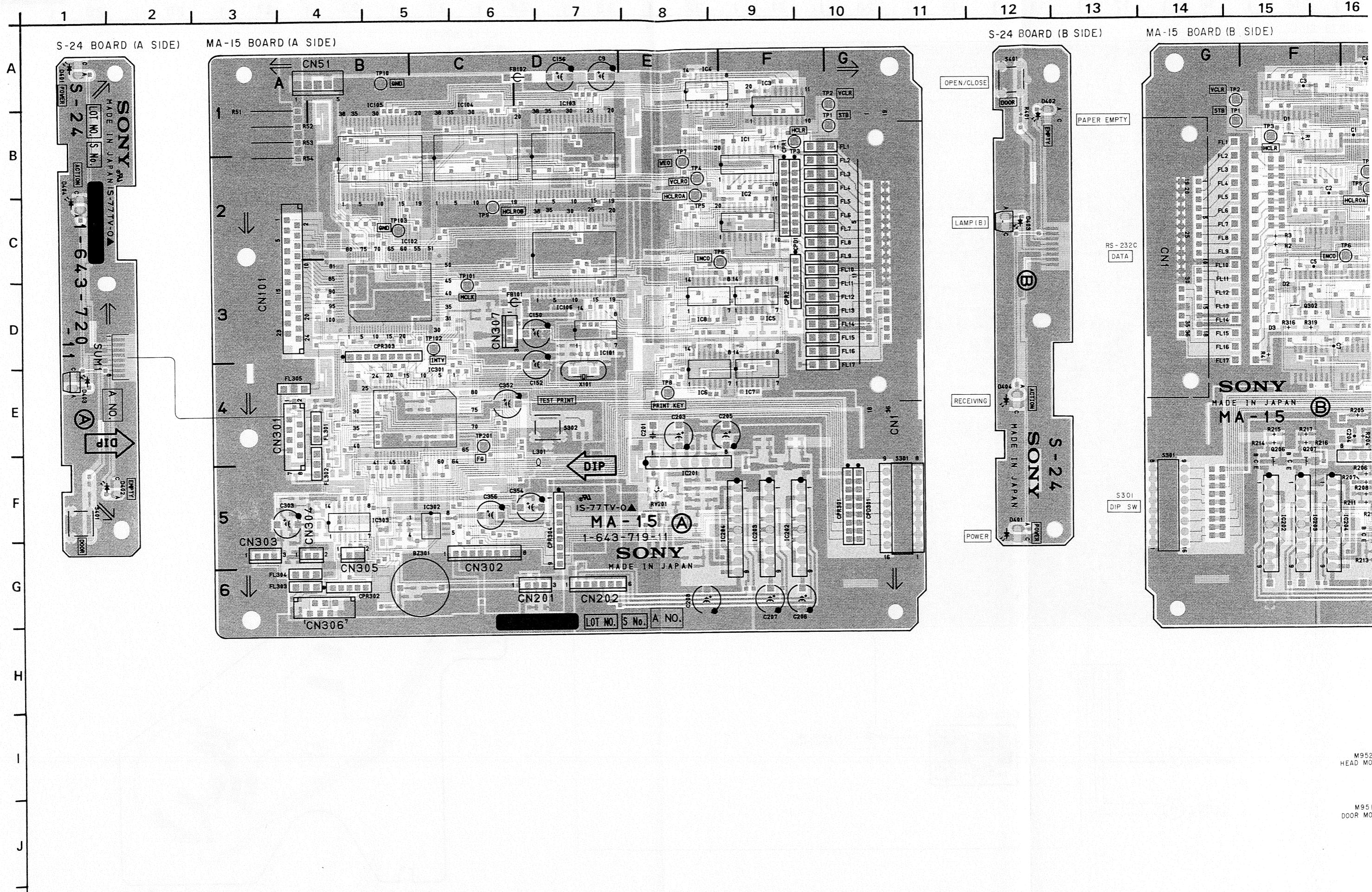
N



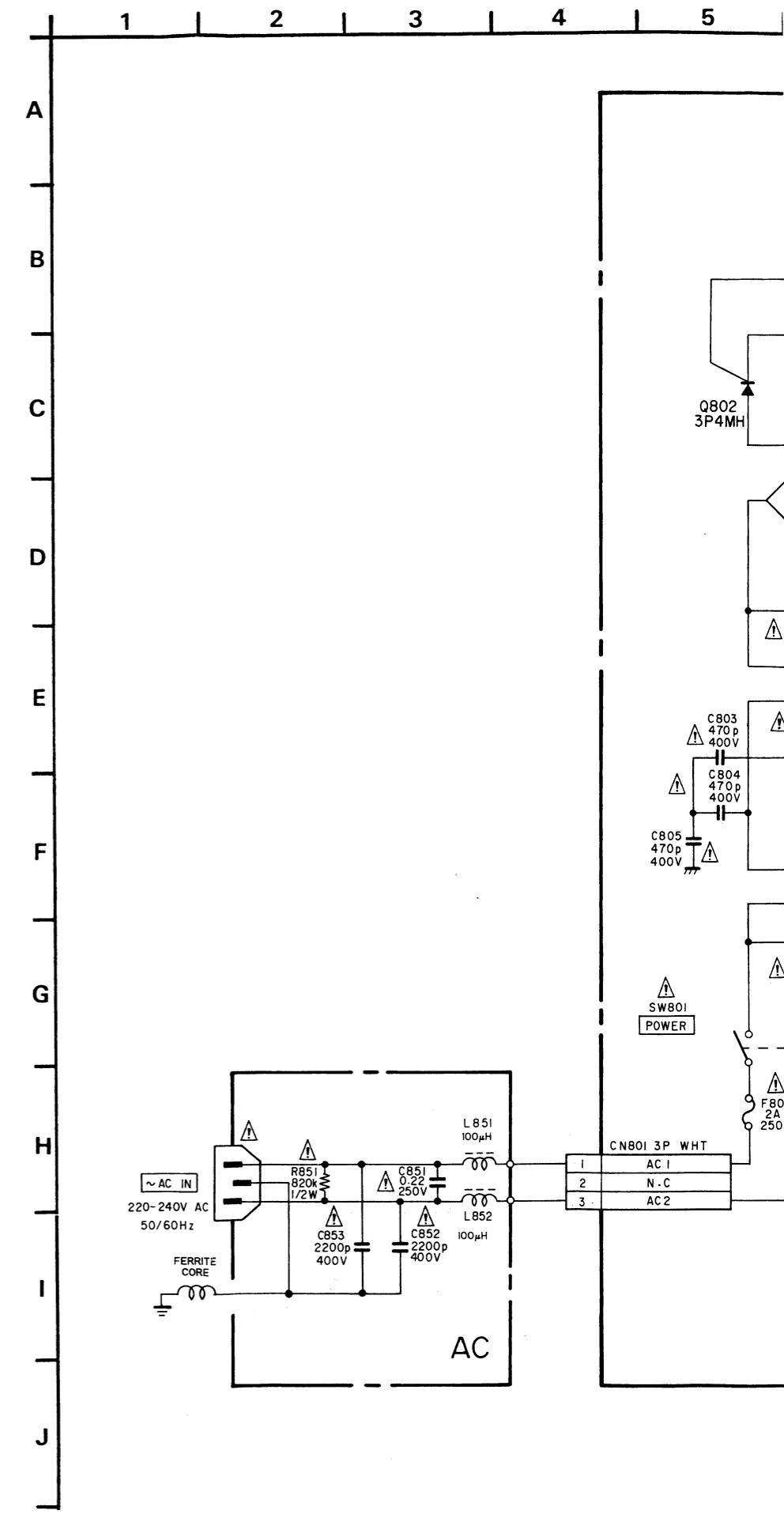


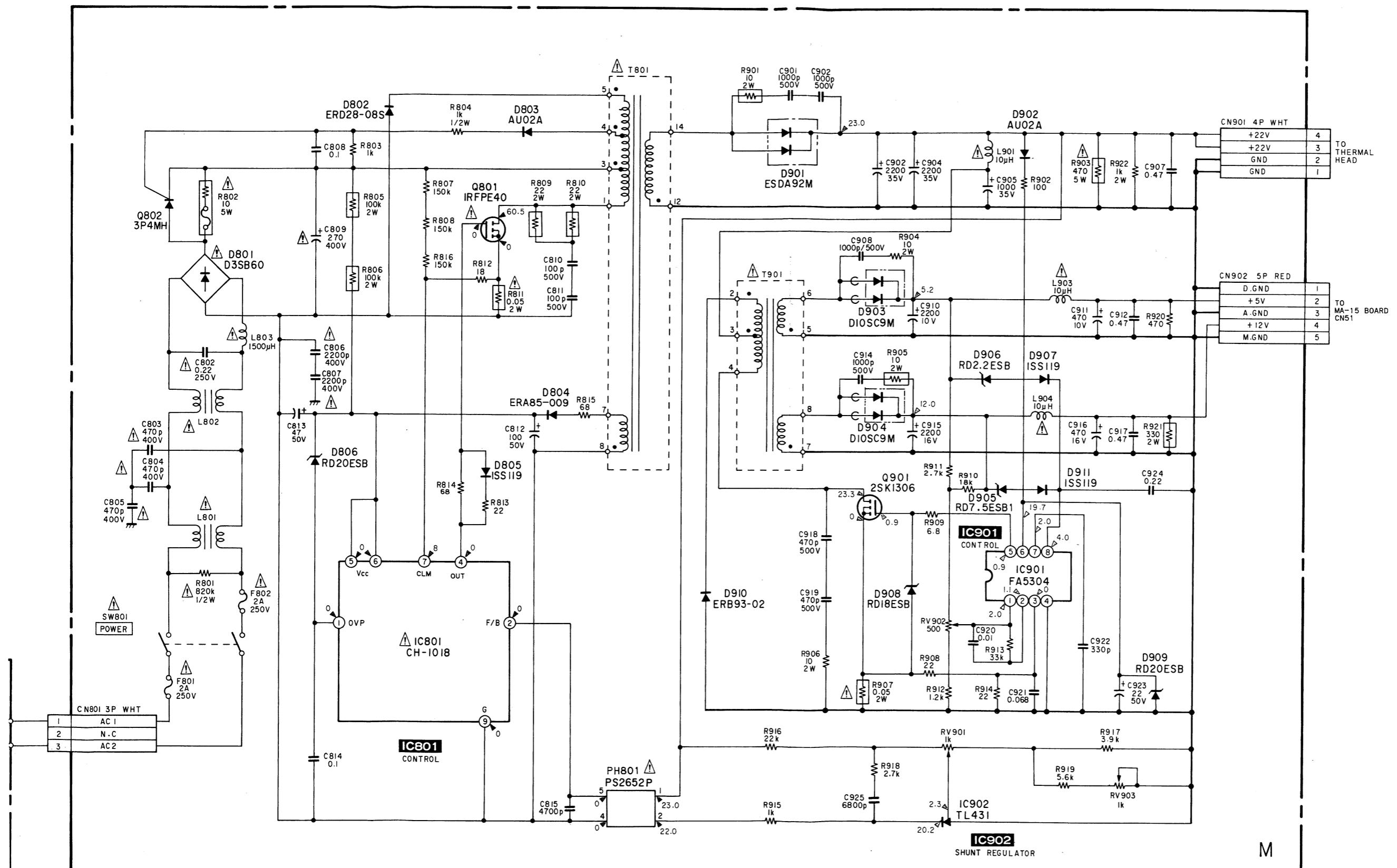


MA-15 (MEMORY CONTROL, VIDEO, SYNC) S-24 (USER CONTROL) SE-9 (POS. SENSOR) PTC-21 (PAPER SENSOR) SU-2 (PLATEN MOTOR) LE-6 (LAMP) C-18 (SENSOR)

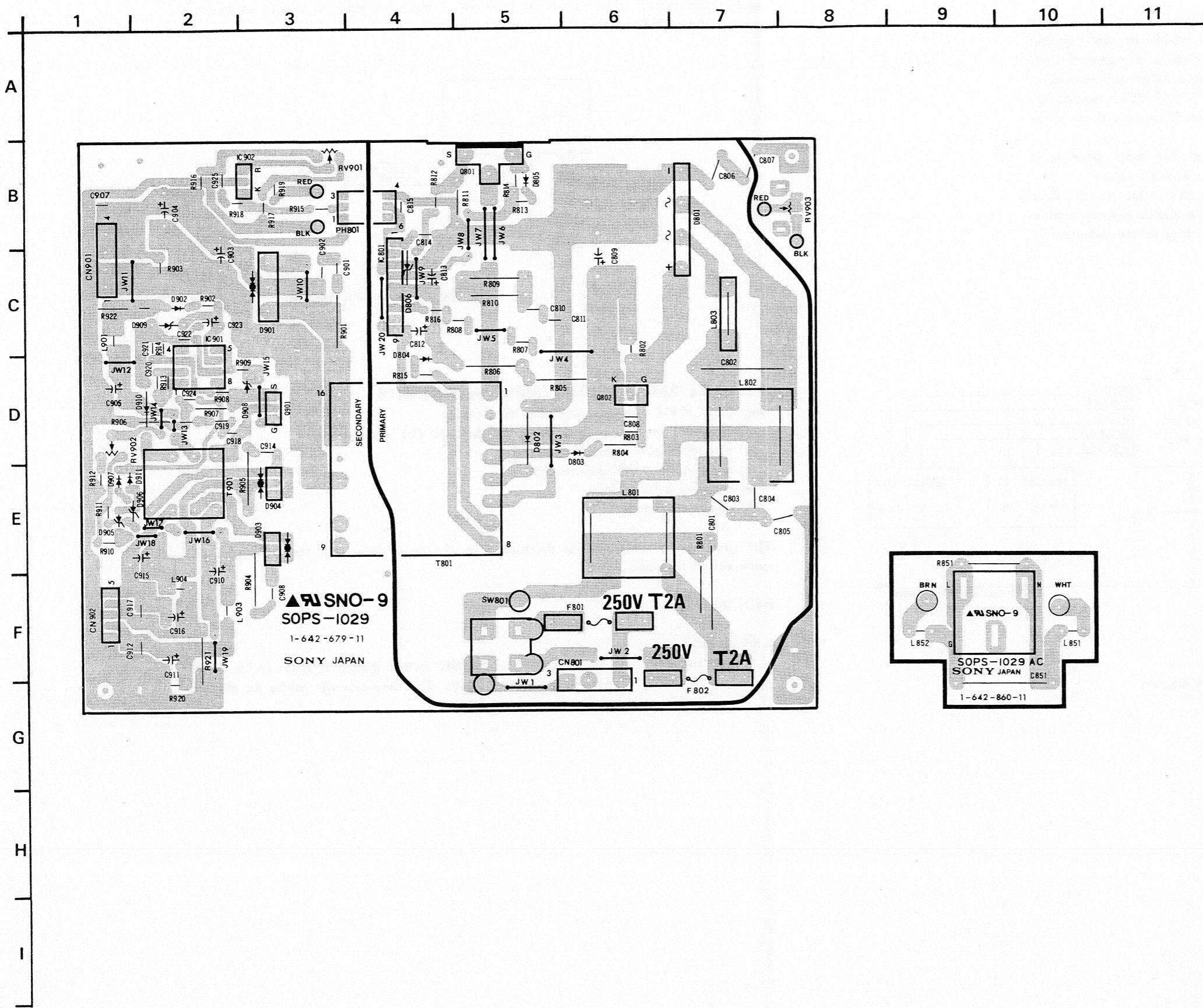


IC		D	
IC1	F-2	D1	F-1
IC2	F-2	D301	B-5
IC3	F-1	D302	B-5
IC4	E-1	D303	B-4
IC5	F-3	D304	B-5
IC6	E-4	D305	D-4
IC7	F-4	ADJ	
IC8	E-3	ADJ	
IC101	D-3		
IC102	B-3	RV201	E-5
IC103	D-2	TP	
IC104	C-2	TP	
IC105	B-2	TP	
IC106	D-3	TP1	G-1
IC201	E-5	TP2	G-1
IC202	F-5	TP3	F-1
IC203	F-5	TP4	E-2
IC204	F-5	TP5	E-2
IC301	B-4	TP6	E-3
IC302	C-5	TP7	E-2
IC303	B-5	TP8	E-4
Q		TP9	C-2
Q		TP10	B-1
Q		TP101	C-3
Q201	E-5	TP102	C-3
Q202	E-5	TP103	B-2
Q203	E-5	TP201	C-4
Q204	E-5		
Q205	E-5		
Q206	F-5		
Q207	F-5		
Q301	A-4		
Q302	F-3		
Q303	C-3		
Q304	C-3		
Q305	A-5		
Q306	A-5		





M (POWER SUPPLY) AC (AC IN)



SECTION 6

CIRCUIT DESCRIPTION

6-1. DESCRIPTION OF IMAGE DATA INPUT BLOCK(I/F) CIRCUIT

The 6-bit image data from the host computer is input through pins 4 to 9 of connector CN1 to the MA-15 board. Control signals \overline{ISTB} , VCLR, and HCLR are sent together with the image data. These signals are input through pins 1, 2, and 3 of connector CN1. Control signals other than \overline{ISTB} , and data are passed through a buffer and latched at the rising edge of the \overline{ISTB} control signal. The latched VCLR and HCLR signals are converted into a signal that controls the memory write address. Each data is stored in the memory address specified by control signals.

The RECEIVING lamp of this set lights during data transfer. The lamp operation is controlled by the VCLR and HCLR signals and the CPU.(Refer to 6-3-1 (2))

Other signals of connector CN1 are used to report the printer state to the host computer or to control the print condition of a printer. These signals directly communicate with the CPU of this set. For more details, refer to 6-4(iv) or the definition of signal on page 7.

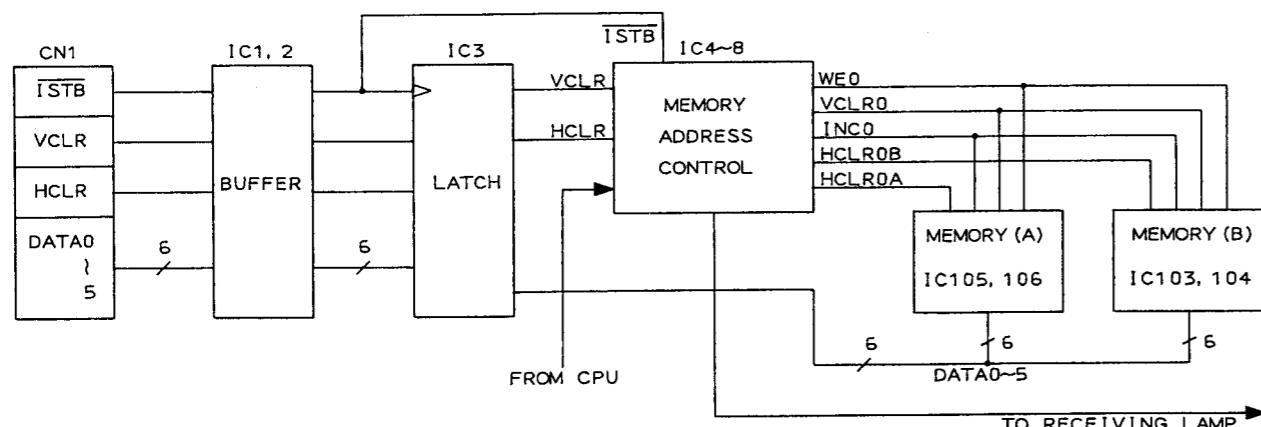
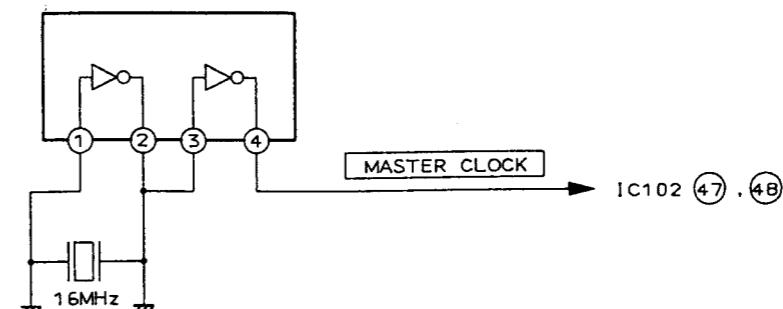


Image data input block diagram

6-2. OSCILLATION CIRCUIT

A 16 MHz master clock is output from pin 4 when an external crystal oscillator is connected to IC101.



Master clock schematic diagram

6-3. GATE ARRAY IC102 PERIPHERAL CIRCUITS

Gate array IC102 comprises the following blocks:

- (1) Registers for storing serial data from the CPU (for mode setting)
- (2) Frame memory write/read control
- (3) one-line print timing generation
- (4) Thermal head control
- (5) one-line memory

The operation of each block is determined by the serial data from the CPU and the mode switch terminals.

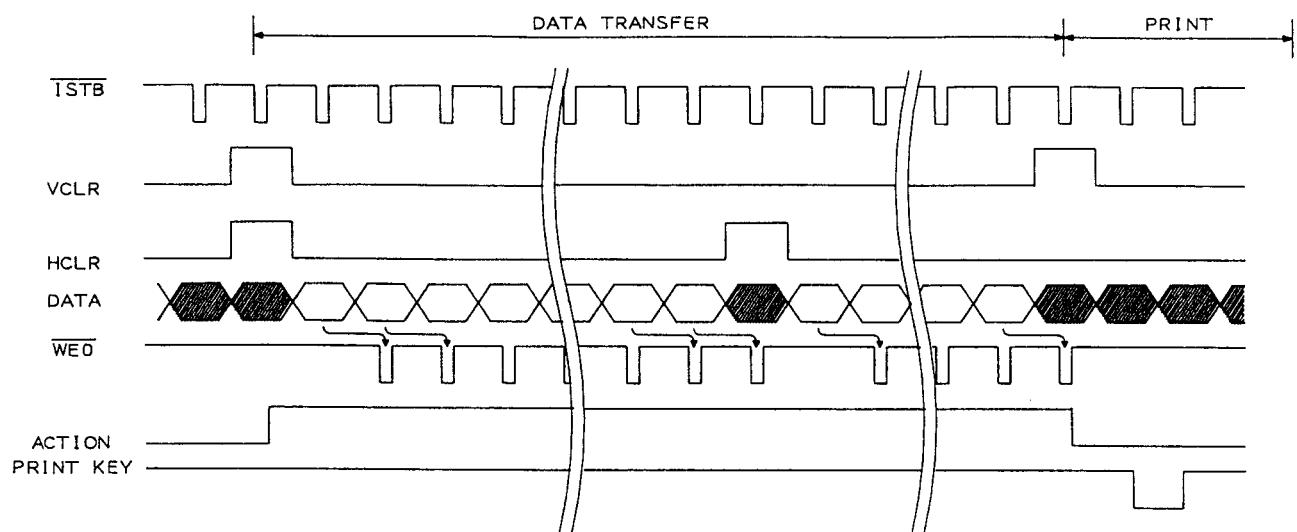
6-3-1. Operations

1. Mode setting

When the CPU has judged the states for DIP switch (S301), it sends 64-bit serial data to the shift register in gate array IC102. The data sets the modes for all the blocks in the gate array.

2. Writing to the frame memory

When VCLR and HCLR pulses are simultaneously sent from the host computer, the next data is stored in memory as first data and sequentially written in the ISTB timing. When only the HCLR pulse is sent, the line address of memory is advanced by one step and the next data is written. By such a repeated routine, data is stored in all the addresses of memory. Only the VCLR pulse is sent after the last data. As a result, a PRINT KEY signal at pin 16 of IC301 is set low. The write completion and print start are reported to the CPU. The WE0 signal at pins 13 of IC103 through IC106 changes as shown below. RECEIVING lamp ON signal ACTION at pin 7 of connector CN301 also changes as shown below and reports that data is being transferred.

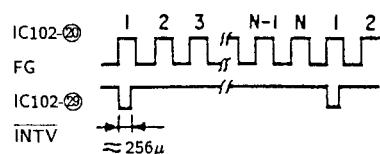


Frame memory writing timing chart

3. Print timing generation

INTV, the timing pulse for printing one line is made by counting down the FG pulses for the DC servo motor. The count down number, N, is determined by the serial data from the CPU. Changing this value changes the print period and, since the motor speed is fixed, changes the print line pitch. This line pitch is selected at pin 5 of DIP switch S301. In addition to the print timing, the INTV pulse is used to detect the motor speed by CPU. The CPU judges the motor speed from the INTV pulse period and stops the motor if it detects any abnormality.

Count down number, N

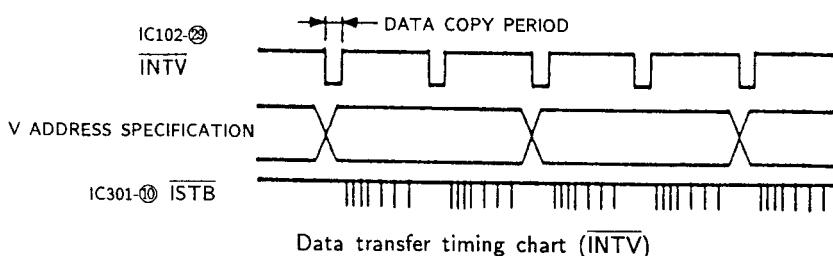


LINE PITCH	NORM	WIDE
<u>N</u>	6	7

4. Copying from frame memory to one-line memory

When a COPY pulse is input to pin 8 of IC102 from the CPU, IC102 sets a COPYING(pin 27 of IC102) pulse low and enters the printing mode.

In order to print it, the one-line data selected from the frame memory, must be copied to the one-line memory in gate array IC102. The frame memory consists of two blocks, A and B. When IC102 specifies the V direction address for the memory, the data with the same V direction address is output from blocks A and B. Since the V direction address changes for every two-line print, data is copied to the one-line memory in IC102 while blocks A and B are alternately switching using a selector in IC102. The data is copied during the low period of each INTV pulse.

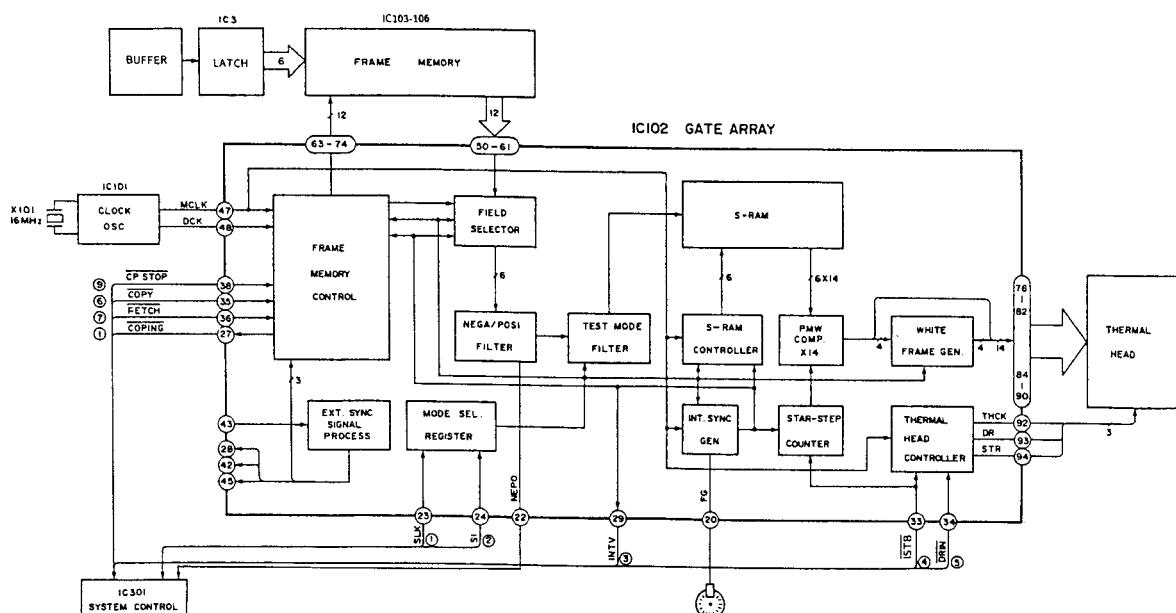


5. Reading out from one-line memory

Data is read out from the one-line memory while INTV is high. When the ISTB pulse is input to pin 33 of IC102 from the CPU, the gate array starts to read from the one-line memory. The read out data is input to the gate array and compared with the gradation counter. The result is converted from serial data to parallel data and sent to the thermal head. It is latched at the thermal head head using the next ISTB pulse. When the CPU issues the DR signal, the thermal head turns on according to the latched data. This read-out operation is repeated 64 times while INTV is high to complete the printing of one line.

6. End of printing

The CPU specifies the print start V address and the print end V address with serial data. The V address is incremented or decremented in DIRECT mode. When gate array IC102 completes the specified range of printing, it returns COPYING to high to tell the CPU that printing of one screen is complete.



Gate array IC102 peripheral block diagram

6-4. SYSTEM CONTROL SECTION

PRINT preparations

- (i) Turn on the power and check that the POWER LED lights.
- (ii) Set paper in place, close the door, and check that the PAPER EMPTY LED goes off.
- (iii) Check that the host computer (or the equivalent) and connector CN1 are connected using a Centronics interface cable.
- (iv) Other signals of connector CN1 in section 6-1 are described below:
The BUSY (at pin 11,) PE (at pin 12), ERROR (at pin 32), and DOOR OPEN (at pin 34) signals output from a printer indicate that the printer does not accept the data transfer from the host computer.

Signal name	State Printing	No paper	Door open	Head heat up
BUSY	H	H	H	H
PE	L	H	H	L
ERROR	H	L	L	L
DOOR OPEN	H	H	L	H
PAPER EMPTY lamp	Goes off	Lights	Lights	Blinks

The relation between the signals and printer state is as shown in the table above. The PAPER EMPTY lamp also varies (goes off, lights, or blinks) depending on the printer state.

The AUTO FEED pulse at pin 14 and the INIT pulse at pin 31 that are input from the host computer control the print condition. The AUTO FEED pulse is valid when the PAPER FEED pulse at pin 7 of DIP switch S301 is "MODE I"(ON). The AUTO FEED pulse performs a paper feed after print when it is low. It performs no paper feed when high. The INIT pulse is used to stop the print operation halfway. It is valid when a low pulse of more than 1 μ sec is input.

* Note 1: When the paper is set in place,
pin 57 of IC301 "L" and pin 58 of IC301 "L".
These conditions are met, IC301 switches off PAPER EMPTY LED.
(pin 4 of IC301)

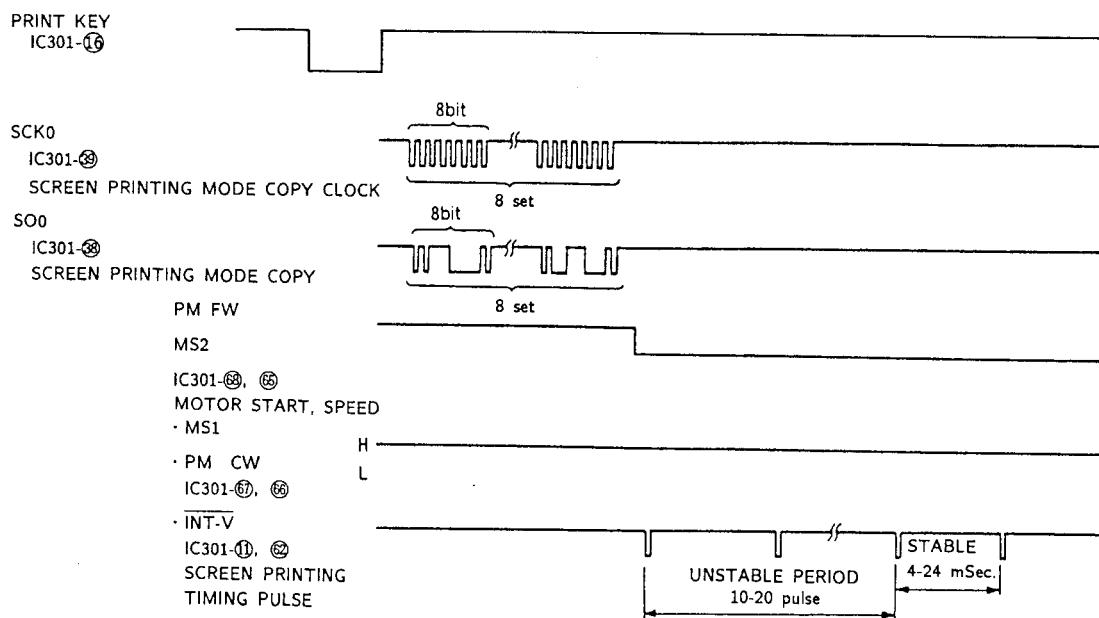
* Note 2: Pin 32 of IC301 is the reset terminal. When the power is first turned on, this pin is held low for a few msec, then set high to end the reset.

6-4-1. MEMORY WRITING FROM DATA TRANSFER

This Item is refer to 6-3-1 2.Writing to the frame memory.

6-4-2. From memory writing till screen printing

[I] From after memory writing till the INT-V pulse measurement.



Timing from memory writing till printing

Operation

The data input to frame memory (IC103 through IC106) is printed in accordance with the procedure below.

- The CPU rotates the head U/D motor (pins 63 and 64 of IC301: "H", "L") when it detects that the PRINT KEY pulse at pin 16 of IC301 is low. Then, the CPU stops the motor (pins 63 and 64 of IC301: "H", "H") after confirming that the head goes down (pins 59 and 60 of IC301: "L", "H"). When the PAPER FEED pulse is "MODE II", the CPU rewinds the paper simultaneously. The platen motor is then rotated in reverse (pins 67 and 68 of IC301: "L", "H"). The platen motor stops when it returns to the specified position (pins 67 and 68 of IC301: "H", "H").
- In order to specify the output format for the data from frame memory, it is synchronized with the signal at the SCK0 terminal and the data is copied from the SO0 terminal to pin 24 of IC102 (SI terminal).
- When the data transfer is complete, the motor is rotated, INT-V is generated from pin 29 of IC102, and input to pins 11 and 62 of IC301. The operations of the PM FW(pin 68 of IC301), PM CW(pin 67 of IC301), MS1(pin 66 of IC301), and MS2 (pin 65 of IC301) signals are as follows :

PM FW, PM CW ————— Turn ON/OFF the platen motor (forward, reverse)
 MS1, MS2 ————— Switches HIGH/LOW of the platen motor speed,
 between 2 to 4 speed.

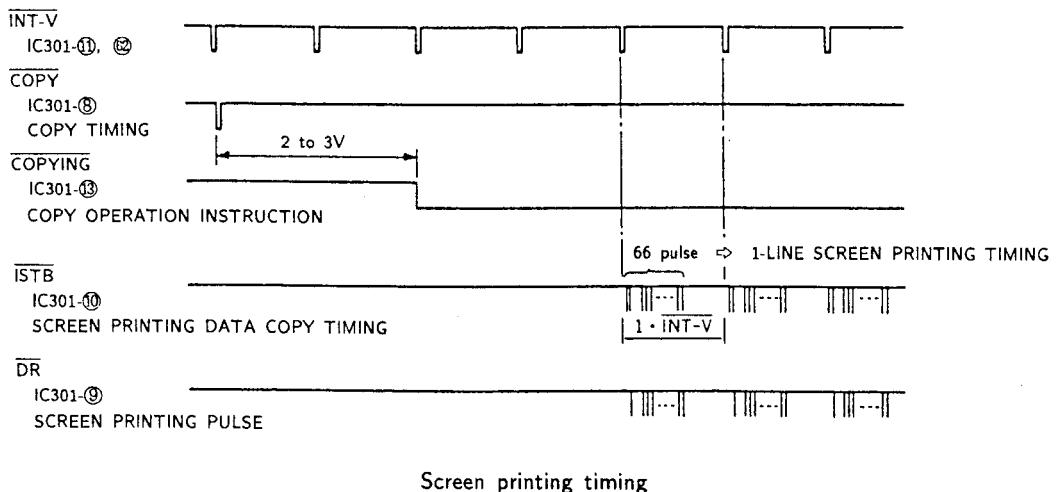
Here are the terminal states for each mode.

	PM FW	PM CW	MS1	MS2
STOP	H	H	H	H
Print	L	H	H	L
Fast forward	L	H	L	H
Rewind	H	L	L	H

*Note: Since INT-V is made by counting down the FG frequency for the motor servo, if the motor is not turning, it is not output.

(iv) When the platen motor is turning and the FG pulse are input to pin 20 of IC102, INT-V is output from pin 29 of IC102, and input to pins 11 and 62 of IC301. Within IC301, INT-V is measured for about 10 to 20 pulses to ensure that INT-V has a fixed pulse width. After verifying that the pulse period is 4 to 24 msec, the system moves to the next screen operation.

[II] From INT-V pulse measurement to screen printing

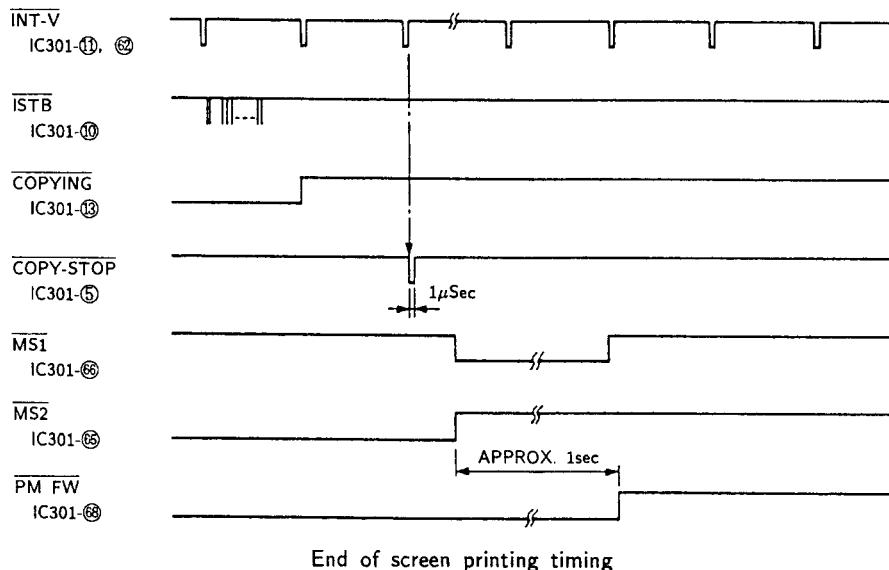


Operation

- When the platen motor rotation is stabilized and the INT-V period is stable, the COPY pulse is output to pin 35 of IC102 synchronized with INT-V.
- When the COPY pulse is input to pin 35 of IC102, IC102 outputs the COPYING pulse from its pin 27 to pin 13 of IC301 to tell it that IC102 is standing by for screen printing.
- When IC301 verifies that COPYING is "L", it outputs ISTB and DR. The screen printing timing is set by these signals.

*Note: If the period of INT-V fluctuates too greatly during screen printing, printing is stopped.

[III] To the end of screen printing and stopping



Operation

(i) IC102 counts the printing lines and when the specified number of lines have been printed, it outputs a "H" signal from its pin 27 of IC102 to pin 13 of IC201, which tells IC301 that the printing operation has ended and it outputs the COPY-STOP pulse.

*Note: The COPY-STOP pulse is also output even if COPYING is "L", if IC 301 judges that something abnormal has arisen. In such a case, when this COPY-STOP pulse is input to IC102, it sets COPYING "H". This characteristic can be used to analyze any problem that causes printing to stop. If COPY-STOP was issued while COPYING is "L", the cause is related to IC301 screen printing is then stopped. If COPY-STOP was issued while COPYING is "H", the cause is related to IC102.

(ii) After the COPY-STOP pulse, MS1, MS2 are changed to fast forward for about one second, then PM FW is set "H" to stop. Reverse the Head U/D motor (pins 63 and 64 of IC301 : "L", "H") and check that the Head goes up (pins 59 and 60 of IC301 : "H", "L"). Then stop the motor.(pins 63 and 64 of IC301 : "H", "H").

6-4-3. Mode set

Number 1 through 8 of DIP switch S301 on the rear panel are input to IC301 to select each screen printing mode. The mode set is input from pin 38 of IC301 to pin 24 of IC 102 in serial data format when the PRINT KEY (pin 16 of IC301) goes low.

Each screen printing mode cannot be selected during screen printing.

6-5. MOTOR DRIVE SECTION (IC201)

The platen motor, Head UP/down motor, and Door motor are driven with IC201, IC202, IC203, and IC209. They are all controlled by IC301.

6-5-1. Platen motor

The platen motor speed is controlled by IC201(M51970L). The frequency of the FG(optic read out) of the motor section is detected and fed back to IC201, which controls motor drive transistor Q205 to control the speed.

IC204(M54544AL) can drive the motor in the forward or reverse direction.

The motor is turned ON/OFF and its speed controlled by pins 65, 66, 67 and 68 of IC 301. (See the explanation of the system control section.)

Since this unit produces the $\overline{INT-V}$ signal that provides the screen printing timing by dividing the FG frequency, even if there is some slight fluctuation in the FG frequency, the paper feed distance and printing quality are held constant.

6-5-2. Head U/D motor and DOOR motor

The Head U/D motor and DOOR motor are controlled by IC202 and 203 (both are M 54543L). This IC can drive the motor in the forward or reverse direction, and it is controlled by pins 27, 28, 63 and 64 of IC301.

Head U/D motor

	IC301 pins		Operation
	63	64	
Down	H	L	Goes down the head
Up	L	H	Goes up the head
Stop	H	H	Locks the motor

Door motor

	IC301 pins		Operation
	27	28	
Open	L	H	Opens the door
Close	H	L	Closes the door

The above motors operation are controlled by detecting the condition of Head and Door with pins 25, 26, 59 and 60 of IC301.

Head condition

	IC301 pins		Condition
	59	69	
Top	L	L	Top position of the head to open the door.
Middle	H	L	Head is at this state except for PRINT
Bottom	L	H	Head is pressed against the platen.

Door condition

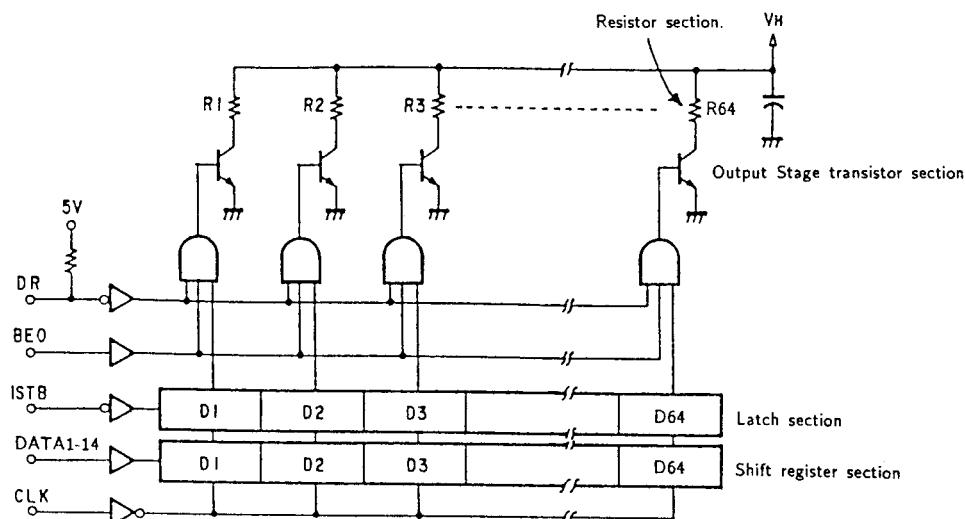
	IC301 pins		Condition
	26	25	
Open	L	H	The door is opened.
Close	H	L	The door is closed.

6-6. THERMAL HEAD SECTION

The thermal head of this unit comprise one-line of 896 dots (64 bits×14) and prints out the screen vertically.

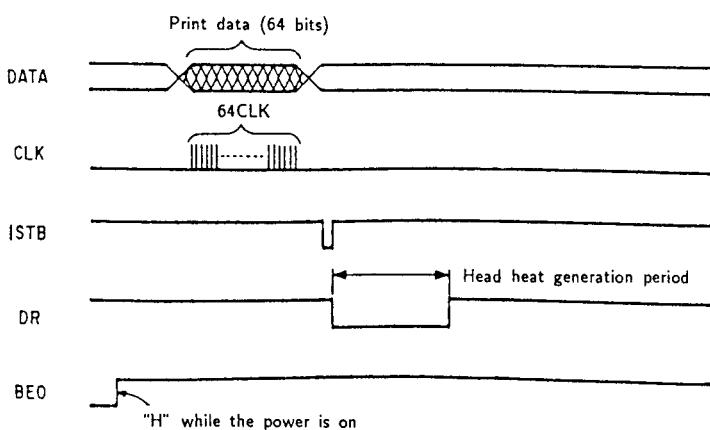
6-6-1. Configuration

There are fourteen sets of the assemblies shown below. (The DATA inputs are DATA 1 to 14. The other terminals are common.)

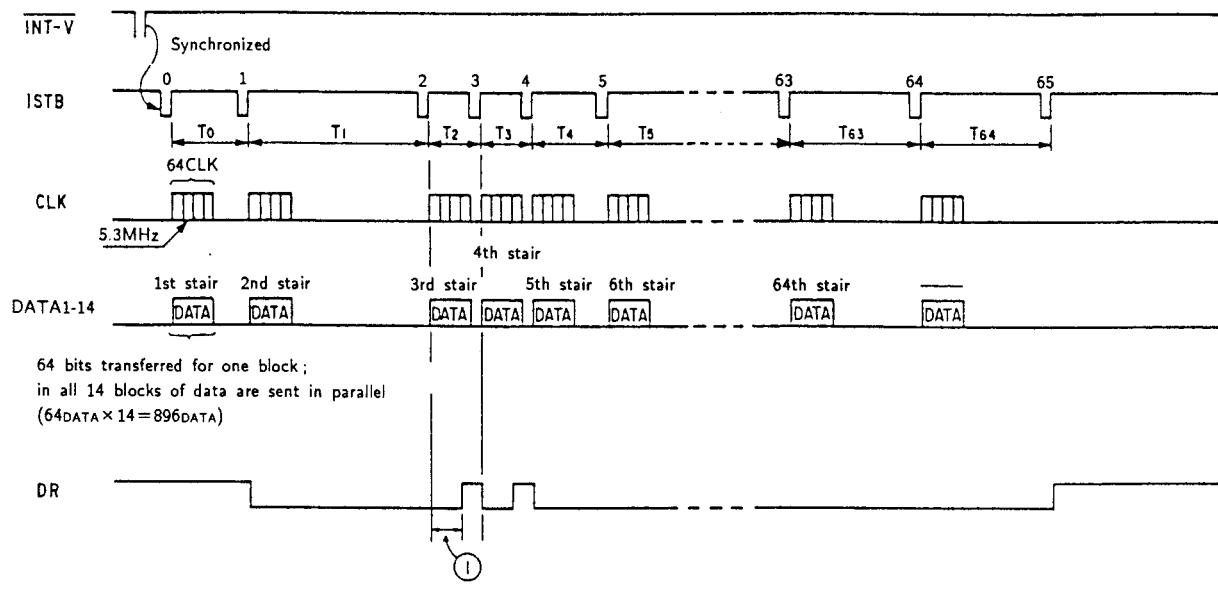


Head internal circuit configuration

6-6-2. Timing Chart



Timing chart



Stair generation

6-6-3. Basic operation

All the signals are input to head from IC102. This section only explains the operations for one block. (The operations for the other blocks are the same.)

- The 64 data items of screen printing are input to the shift register synchronized with CLK.
- When the STB pulse is input, the data input in (i) is moved from the shift register section to the latch section.
- When the DR pulse is input, the output stage transistors are switched ON/OFF by the "H" and "L" latch section data. While the transistors are on, the resistors heat up and thermosensitive paper changes color. The amount of heat generated is controlled by varying the length of the DR pulses, so the color darkness of the printing on thermosensitive paper can be varied.

* Note: The BEO terminal goes from "L" to "H" only when the power is turned on. After that it stays "H".

6-6-4. Stair generation

As explained in the last section on basic operation, the darkness of the printing can be controlled with the DR pulses, but it is also possible to change the darkness by changing the high and low data input to the latch section. This section explains this method.

- The data sent from the host computer to the frame memory (IC103 through IC106), in the print operation is input to the stair data generation circuit of IC102 by 1H (one line). The stair data generation circuit outputs the 6 bits of data recorded in IC102 as one of 64 levels. If the 6 bit data is "3", then DATA "H" is sent to the head during the 1st, 2nd, and 3rd stairs of DATA 1 through 6 in the chart above, but from the 4th stairs and later, the DATA "L" is sent.

In this way, the screen is printed with the third stair, but from the fourth stair and later is not printed. (See explanation of the basic operations in 6-6-3.)

- (ii) The data is input to IC102, when the "0" ISTB pulse synchronized with INT-V is input, the first stair data is sent to the head shift register section synchronized with CLK.
- (iii) When the "1" ISTB pulse is input, the first stair data is transferred to the latch section and the second stair data is input to the shift register section. At the same time, the DR pulse goes to "L" and the "H" data among the data input as the first stair data switches on the corresponding output stage transistors, heating up the corresponding resistors. The "L" data switches off the corresponding output stage transistors so those resistors do not heat up. This operation is carried out 64 times. If "H" data is sent the 1 through 64 times, the resistors generate heat the entire time and the printing is the blackest possible. If the data is only high until the 32 times, the printing is an intermediate stair. This is how intermediate stairs are generated by sending high data a certain number of times and generating heat in the resistors that many times.
- (iv) Thus, by controlling the time until the next data is transferred to the latch, the darkness of intermediate stairs can be controlled by changing the ISTB intervals, T_0 , T_1 , T_2 , T_3 , T_4 , ..., T_{63} , T_{64} . Specifically, IC301 matches the intervals T_1 through T_{64} to the paper's γ characteristic (the degree of darkening relative to the heat applied). This is called γ characteristic control.
- (v) If the DR pulse is also controlled as described in 6-6-3 (section ① in the timing chart of previous page), even fine stair can be expressed.

* Note: The section ① is generated when the ISTB pulse T interval is 26 μ sec.
(The ISTB pulse T interval is a minimum of 26 μ sec.)

Thus, this unit provides smooth expression of intermediate stairs by controlling the ISTB pulse T interval and the DR pulses.

6-6-5. Temperature compensation

As explained in 6-6-4, intermediate stairs are expressed by controlling the ISTB pulse T interval and the DR pulses, but since the energy required to make thermosensitive paper turn color varies with the room temperature and with the heat generated by and built up in the printing head during continuous printing.

This unit has a built-in thermistor (pins 19 and 20 of CN101), IC301 measures the change in the head temperature and to compensate for temperature change controls the ISTB pulse T interval and the DR pulse, just as is done for stair generation. Specifically, when the temperature rises it reduces the ISTB pulse T interval and the DR pulses, but when the temperature falls, it increases the ISTB pulse T interval and the DR pulses.

SECTION 7

EXPLODED VIEWS

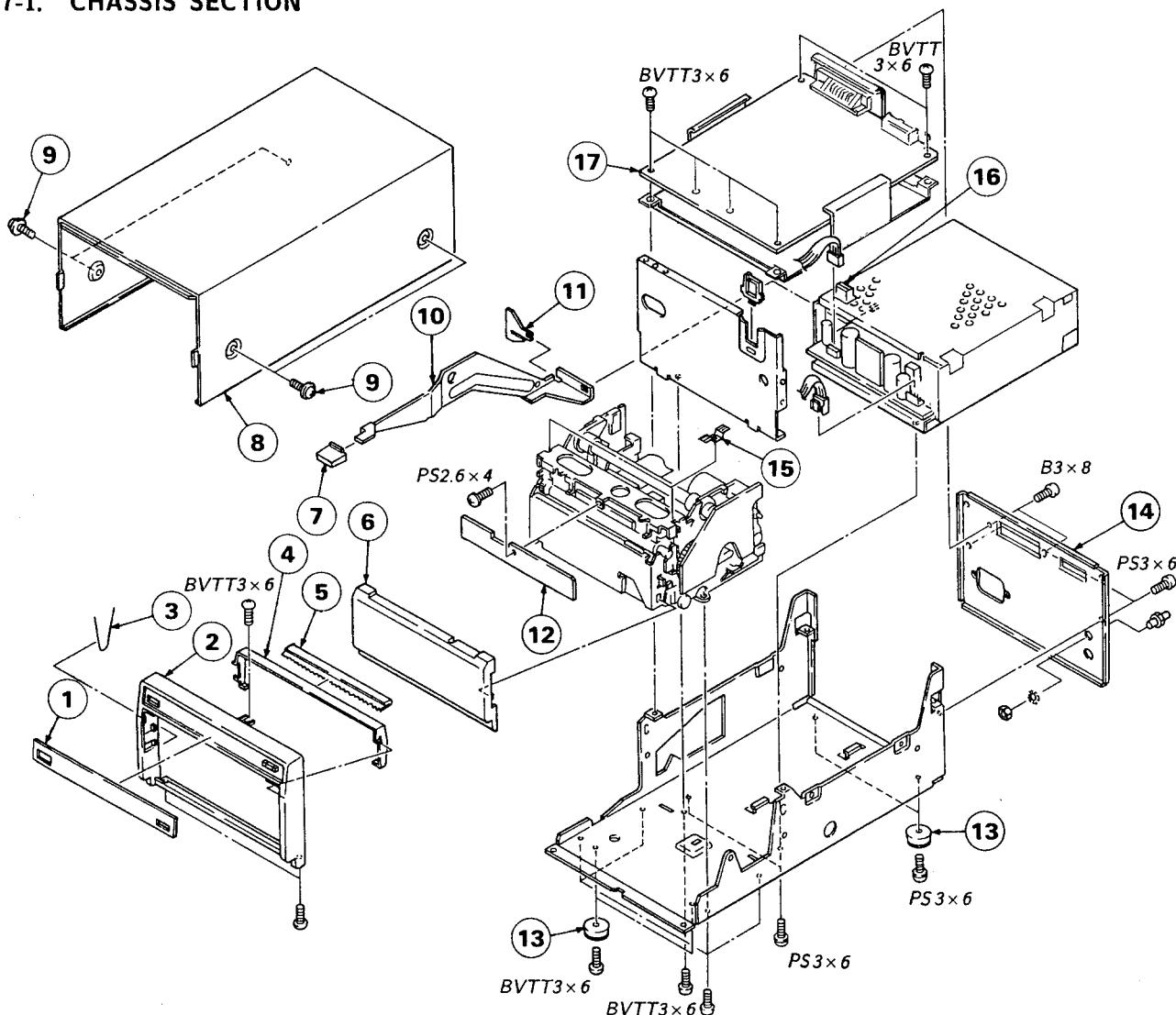
NOTE:

- Items with no part number and no description are not stocked because they are seldom required for routine service.
- The construction parts of an assembled part are indicated with a callout number in the remark column.

- Items marked "*" are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.

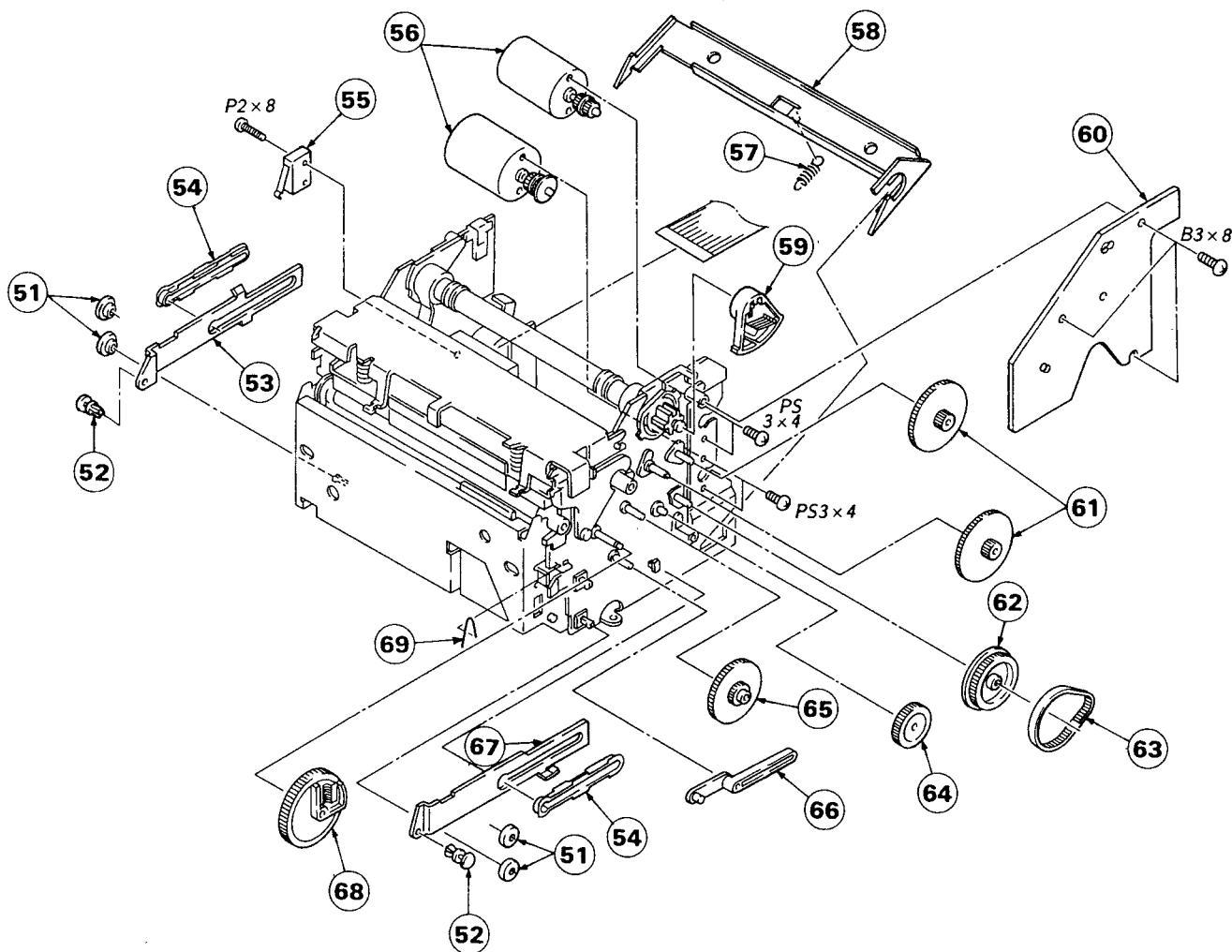
The components identified by shading and mark  are critical for safety. Replace only with part number specified.

7-1. CHASSIS SECTION



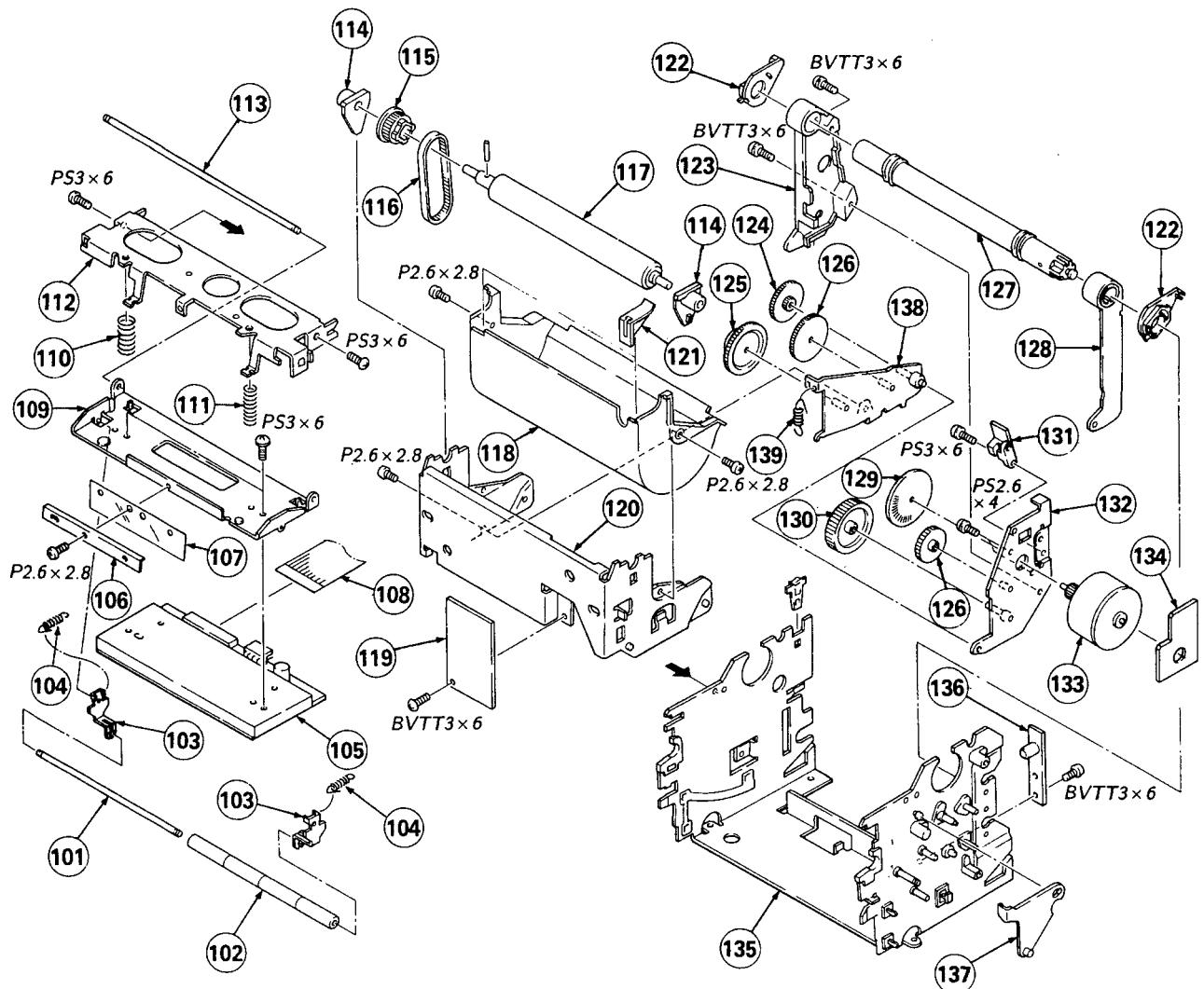
Ref. No.	Part No.	Description	Remark	Ref. No.	Part No.	Description	Remark
1	3-176-275-01	SHEET, FRONT PANEL		11	*3-173-922-02	STOPPER, ROD	
2	3-173-924-21	PANEL, FRONT		12	*1-643-720-11	S-24 BOARD	
3	3-173-604-01	SPRING, CUTTER		13	3-734-866-01	FOOT	
4	3-173-618-03	HOLDER, CUTTER		14	*3-176-274-01	PANEL, REAR	
5	3-741-060-05	CUTTER		15	*3-174-629-01	PLATE, GROUND	
6	3-173-624-71	PANEL, DOOR		16	*3-642-310-00	HOLDER, CIRCUIT BOARD	
7	3-174-998-01	BUTTON, POWER		17	*A-8271-324-A	MA-15 BOARD, COMPLETE	
8	*3-173-622-31	COVER, TOP					
9	4-886-821-11	SCREW, M3 CASE					
10	*3-173-923-11	ROD, POWER SWITCH					

7-2. PRINT MECHANISM SECTION (1)



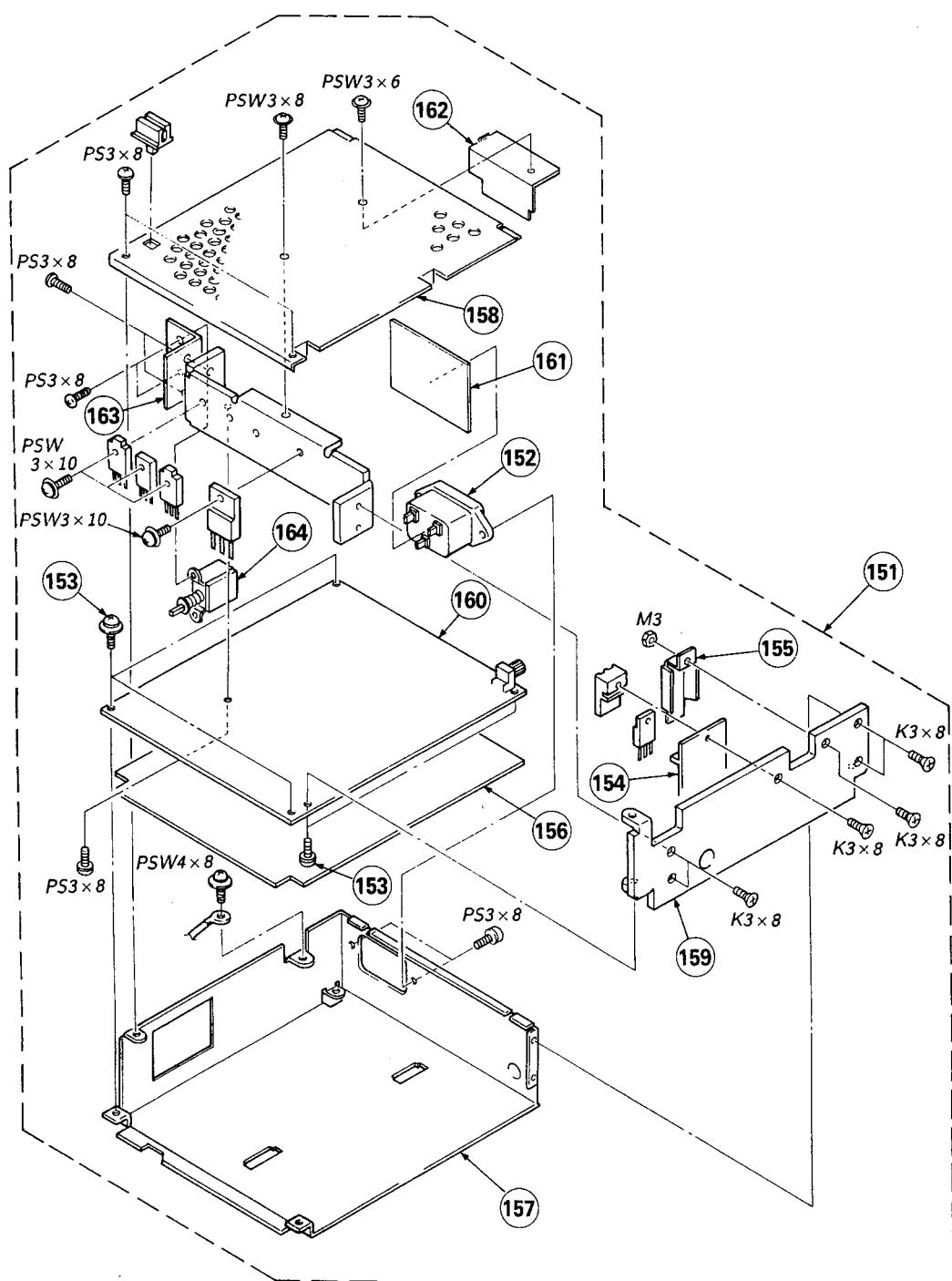
Ref. No.	Part No.	Description	Remark	Ref. No.	Part No.	Description	Remark
51	3-741-065-01	ROLLER, SLIDE		60	*1-641-592-11	SE-9 BOARD	
52	3-531-576-11	RIVET		61	3-173-550-01	GEAR (D), IDLER	
53	*3-173-554-01	RAIL (L)		62	3-173-553-01	PULLEY (H), GEAR	
54	3-173-558-01	GUIDE, RAIL		63	3-173-560-01	BELT, 90TN	
55	1-554-512-00	SWITCH, MICRO		64	3-173-551-01	GEAR (S), IDLER	
56	X-3166-427-1	GEAR MOTOR, S ASSY		65	3-173-549-01	GEAR (H), IDLER	
57	3-173-559-01	SPRING (LOCK) TENSITON		66	3-173-556-01	LINK, EJECT	
58	*3-173-981-02	ARM, LOCK		67	*3-173-555-01	RAIL (R)	
59	X-3166-380-1	GEAR ASSY, DOOR		68	X-3166-379-1	GEAR ASSY, CAM	
				69	*3-173-548-01	SPRING, GROUND	

7-3. PRINT MECHANISM SECTION (2)



Ref. No.	Part No.	Description	Remark	Ref. No.	Part No.	Description	Remark
101	*3-173-562-02	SHAFT, PRESS		121	3-741-062-11	STAY, ROLL	
102	3-745-319-01	ROLLER, PRESS		122	3-173-557-01	BEARING, ARM	
103	*3-173-979-02	HOLDER, PRESS		123	3-173-612-01	ARM (L)	
104	3-173-563-02	SPRING (PRESS), TENSION		124	3-173-581-01	GEAR (G), IDLER	
105	1-543-879-11	HEAD, THERMAL(KST-100-9MPL14-SN)		125	3-173-616-02	PULLEY(P), GEAR	
106	*3-173-564-01	HOLDER, SHEET		126	3-173-566-01	GEAR (A)	
107	*3-174-266-01	SHEET, GUIDE		127	3-173-610-01	PIPE, ARM	
108	1-690-503-11	WIRE, FLAT TYPE (24CORE)		128	3-173-611-01	ARM (R)	
109	*3-173-980-01	HOLDER, HEAD		129	3-176-004-01	FIN, FG	
110	3-173-978-01	SPRING (B), COMPRESSION		130	3-173-565-01	GEAR (M), IDLER	
111	3-173-977-02	SPRING (S), COMPRESSION		131	*1-641-595-11	C-18 BOARD	
112	*3-173-609-02	HOLDER, SPRING		132	*X-3166-382-1	BRACKET ASSY, MOTOR	
113	3-173-547-01	SHAFT, HEAD		133	X-3166-426-1	GEAR MOTOR M ASSY	
114	3-173-579-01	BEARING, PLATEN		134	*1-641-596-11	SU-2 BOARD	
115	3-173-578-01	PULLEY, PLATEN		135	*X-3166-384-2	CHASSIS (OUTSERT) ASSY, MECH	
116	3-174-267-01	BELT, 110TN		136	*1-641-594-11	LE-6 BOARD	
117	3-173-615-01	PLATEN		137	*X-3166-434-2	LINK ASSY, HEAD	
118	X-3166-429-1	TRAY, SLIDE ASSY (E)		138	*X-3166-383-2	BRACKET ASSY, GEAR	
119	*1-641-593-11	PTC-21 BOARD		139	3-173-561-01	SPRING (BELT), TENSION	
120	*3-173-620-01	CHASSIS, INNER					

7-4. POWER SUPPLY SECTION



The components identified by shading and mark Δ are critical for safety. Replace only with part number specified.

Ref. No	Part No.	Description	Remark	Ref. No	Part No.	Description	Remark
151 Δ	*1-413-695-11	SWITCHING REGULATOR (SOPS-1029)		158 Δ	*2-625-759-01	CASE (B-1028)	
152 Δ	1-580-375-11	INLET 3P		159	*2-625-760-01	HEAT SINK (A-1028)	
153	2-430-772-00	SCREW M3X8		160	*A-4915-267-A	M BOARD, MOUNTED	
154 Δ	*2-431-514-11	RUBBER(1028), INSULATING		161	*A-4915-266-A	AC BOARD, MOUNTED	
155 Δ	*2-625-756-02	INSULATOR (B-1028)		162	*2-625-913-01	PLATE, SHIELD	
156 Δ	*2-625-757-01	INSULATOR (A-1028)		163	*2-625-914-01	BRACKET, SWITCH	
157 Δ	*2-625-761-01	CASE (A-1028)		164 Δ	*1-554-880-01	SWITCH, PUSH (AC POWER)(1KEY)	

SECTION 8

ELECTRICAL PARTS LIST

NOTE:

The components identified by shading and mark  are critical for safety.
Replace only with part number specified.

Items marked "*" are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.

When indicating parts by reference number, please include the board name.

• All variable and adjustable resistors have characteristic curve B, unless otherwise noted.

CAPACITORS

COILS

• MF : μ F, PF : $\mu\mu$ F • MMH : mH, UH : μ H

RESISTORS

• All resistors are in ohms
• F : nonflammable

Ref. No	Part No.	Description	Remark	Ref. No	Part No.	Description	Remark
	*A-8271-324-A	MA-15 BOARD, COMPLETE		C303	1-124-915-11	ELECT	10MF 20%
		*****		C304	1-163-038-00	CERAMIC CHIP	0.1MF 50V 25V
		<BUZZER>		C351	1-163-038-00	CERAMIC CHIP	0.1MF 25V
BZ301	1-529-080-11	BUZZER, PIEZOELECTRIC		C352	1-124-915-11	ELECT	10MF 20% 50V
		<CAPACITOR>		C353	1-163-038-00	CERAMIC CHIP	0.1MF 25V
C1	1-163-038-00	CERAMIC CHIP 0.1MF	25V	C354	1-124-915-11	ELECT	10MF 20% 50V
C2	1-163-038-00	CERAMIC CHIP 0.1MF	25V	C355	1-163-038-00	CERAMIC CHIP	0.1MF 25V
C3	1-163-038-00	CERAMIC CHIP 0.1MF	25V	C356	1-124-915-11	ELECT	10MF 20% 50V
C4	1-163-038-00	CERAMIC CHIP 0.1MF	25V			<CONNECTOR>	
C5	1-163-038-00	CERAMIC CHIP 0.1MF	25V	CN1	*1-563-283-11	RECEPTACLE	36P 25V
C6	1-163-038-00	CERAMIC CHIP 0.1MF	25V	CN51	*1-560-893-00	PIN, CONNECTOR	5P
C7	1-163-038-00	CERAMIC CHIP 0.1MF	25V	CN101	*1-563-864-21	SOCKET, CONNECTOR	24P
C8	1-163-038-00	CERAMIC CHIP 0.1MF	25V	CN201	1-506-468-11	PIN, CONNECTOR	3P
C9	1-124-927-11	ELECT 4.7MF	20% 50V	CN202	*1-568-955-11	PIN, CONNECTOR	6P
C101	1-163-099-00	CERAMIC CHIP 18PF	5% 50V	CN301	1-691-417-11	SOCKET, CONNECTOR	8P
C102	1-163-099-00	CERAMIC CHIP 18PF	5% 50V	CN302	1-506-473-11	PIN, CONNECTOR	8P
C103	1-163-105-00	CERAMIC CHIP 33PF	5% 50V	CN303	*1-506-468-11	PIN, CONNECTOR	3P
C104	1-163-105-00	CERAMIC CHIP 33PF	5% 50V	CN304	*1-568-951-11	PIN, CONNECTOR	2P
C105	1-163-105-00	CERAMIC CHIP 33PF	5% 50V	CN305	*1-568-951-91	PIN, CONNECTOR (STRAIGHT)	2P
C106	1-163-105-00	CERAMIC CHIP 33PF	5% 50V	CN306	1-691-416-11	SOCKET, CONNECTOR	7P
C107	1-163-105-00	CERAMIC CHIP 33PF	5% 50V	CN307	1-506-468-11	PIN, CONNECTOR	3P
C150	1-124-927-11	ELECT 4.7MF	20% 50V			<COMPOSITION CIRCUIT BLOCK>	
C151	1-163-038-00	CERAMIC CHIP 0.1MF	25V	CPD1	1-239-230-11	COMPOSITION CIRCUIT BLOCK	
C152	1-124-927-11	ELECT 4.7MF	20% 50V	CPD301	1-239-230-11	COMPOSITION CIRCUIT BLOCK	
C153	1-163-038-00	CERAMIC CHIP 0.1MF	25V	CPR1	1-233-180-11	COMPOSITION CIRCUIT BLOCK	
C154	1-163-038-00	CERAMIC CHIP 0.1MF	25V	CPR2	1-233-179-11	COMPOSITION CIRCUIT BLOCK	
C155	1-163-038-00	CERAMIC CHIP 0.1MF	25V	CPR301	1-232-976-11	COMPOSITION CIRCUIT BLOCK	
C156	1-124-927-11	ELECT 4.7MF	20% 50V	CPR302	1-232-986-11	COMPOSITION CIRCUIT BLOCK	
C157	1-163-038-00	CERAMIC CHIP 0.1MF	25V	CPR303	1-232-976-11	COMPOSITION CIRCUIT BLOCK	
C158	1-163-038-00	CERAMIC CHIP 0.1MF	25V	CPR304	1-232-976-11	COMPOSITION CIRCUIT BLOCK	
C159	1-163-038-00	CERAMIC CHIP 0.1MF	25V			<DIODE>	
C160	1-163-038-00	CERAMIC CHIP 0.1MF	25V	D1	8-719-105-91	DIODE RD5.6M-B2	
C201	1-130-489-00	MYLAR 0.033MF	5% 50V	D2	8-719-105-91	DIODE RD5.6M-B2	
C202	1-163-038-00	CERAMIC CHIP 0.1MF	25V	D3	8-719-105-91	DIODE RD5.6M-B2	
C203	1-124-915-11	ELECT 10MF	20% 50V	D301	8-719-801-78	DIODE 1SS184	
C204	1-164-004-11	CERAMIC CHIP 0.1MF	10% 25V	D302	8-719-105-91	DIODE RD5.6M-B2	
C205	1-124-927-11	ELECT 4.7MF	20% 50V	D303	8-719-105-91	DIODE RD5.6M-B2	
C206	1-124-915-11	ELECT 10MF	20% 50V	D304	8-719-105-52	DIODE RD3.6M-B2	
C207	1-124-915-11	ELECT 10MF	20% 50V	D305	8-719-105-91	DIODE RD5.6M-B2	
C208	1-124-915-11	ELECT 10MF	20% 50V			<FERRITE BEAD>	
C209	1-163-031-11	CERAMIC CHIP 0.01MF	50V	FB101	1-410-397-21	FERRITE BEAD INDUCTOR	
C301	1-163-033-00	CERAMIC CHIP 0.022MF	50V	FB102	1-410-397-21	FERRITE BEAD INDUCTOR	
C302	1-164-182-11	CERAMIC CHIP 0.0033MF	10% 50V				

MA-15

Ref. No	Part No.	Description	Remark	Ref. No	Part No.	Description	Remark
<FILTER>							
FL1	1-236-129-11	ENCAPSULATED COMPONENT		Q302	8-729-901-00	TRANSISTOR DTC124EK	
FL2	1-236-129-11	ENCAPSULATED COMPONENT		Q303	8-729-901-05	TRANSISTOR DTA124EK	
FL3	1-236-129-11	ENCAPSULATED COMPONENT		Q304	8-729-140-75	TRANSISTOR 2SD999-CLK	
FL4	1-236-129-11	ENCAPSULATED COMPONENT		Q305	8-729-230-49	TRANSISTOR 2SC2712G-YG	
FL5	1-236-129-11	ENCAPSULATED COMPONENT		Q306	8-729-230-49	TRANSISTOR 2SC2712G-YG	
<RESISTOR>							
FL6	1-236-129-11	ENCAPSULATED COMPONENT		R1	1-216-049-00	METAL GLAZE 1K 5%	1/10W
FL7	1-236-129-11	ENCAPSULATED COMPONENT		R2	1-216-049-00	METAL GLAZE 1K 5%	1/10W
FL8	1-236-129-11	ENCAPSULATED COMPONENT		R3	1-216-061-00	METAL GLAZE 3.3K 5%	1/10W
FL9	1-236-129-11	ENCAPSULATED COMPONENT		R4	1-216-061-00	METAL GLAZE 3.3K 5%	1/10W
FL10	1-236-129-11	ENCAPSULATED COMPONENT		R51	1-215-867-00	METAL OXIDE 470 5%	1W F
FL11	1-236-129-11	ENCAPSULATED COMPONENT		R52	1-215-867-00	METAL OXIDE 470 5%	1W F
FL12	1-236-129-11	ENCAPSULATED COMPONENT		R53	1-215-867-00	METAL OXIDE 470 5%	1W F
FL13	1-236-129-11	ENCAPSULATED COMPONENT		R54	1-215-867-00	METAL OXIDE 470 5%	1W F
FL14	1-236-129-11	ENCAPSULATED COMPONENT		R101	1-216-121-00	METAL GLAZE 1M 5%	1/10W
FL15	1-236-129-11	ENCAPSULATED COMPONENT		R102	1-216-121-00	METAL GLAZE 1M 5%	1/10W
FL16	1-236-129-11	ENCAPSULATED COMPONENT		R103	1-216-013-00	METAL GLAZE 33 5%	1/10W
FL17	1-236-129-11	ENCAPSULATED COMPONENT		R104	1-216-013-00	METAL GLAZE 33 5%	1/10W
FL301	1-236-129-11	ENCAPSULATED COMPONENT		R105	1-216-013-00	METAL GLAZE 33 5%	1/10W
FL302	1-236-129-11	ENCAPSULATED COMPONENT		R106	1-216-013-00	METAL GLAZE 33 5%	1/10W
FL303	1-236-129-11	ENCAPSULATED COMPONENT		R107	1-216-013-00	METAL GLAZE 33 5%	1/10W
FL304	1-236-129-11	ENCAPSULATED COMPONENT		R201	1-216-099-00	METAL GLAZE 120K 5%	1/10W
FL305	1-236-129-11	ENCAPSULATED COMPONENT		R202	1-216-091-00	METAL GLAZE 56K 5%	1/10W
<IC>							
IC1	8-759-933-65	IC SN74LS244NS		R203	1-216-081-00	METAL GLAZE 22K 5%	1/10W
IC2	8-759-933-65	IC SN74LS244NS		R204	1-216-013-00	METAL GLAZE 33 5%	1/10W
IC3	8-759-931-12	IC SN74LS374NS		R205	1-216-093-00	METAL GLAZE 68K 5%	1/10W
IC4	8-759-929-99	IC SN74LS32NS		R206	1-216-033-00	METAL GLAZE 220 5%	1/10W
IC5	8-759-922-49	IC SN74LS74ANS		R207	1-216-057-00	METAL GLAZE 2.2K 5%	1/10W
IC6	8-759-922-49	IC SN74LS74ANS		R208	1-216-063-00	METAL GLAZE 3.9K 5%	1/10W
IC7	8-759-922-49	IC SN74LS74ANS		R210	1-216-295-00	METAL GLAZE 0 5%	1/10W
IC8	8-759-929-78	IC SN74LS08NS		R211	1-216-053-00	METAL GLAZE 1.5K 5%	1/10W
IC101	8-759-927-29	IC SN74HC04NS		R212	1-216-308-00	METAL GLAZE 4.7 5%	1/10W
IC102	8-759-519-29	IC CXD8284Q		R213	1-216-308-00	METAL GLAZE 4.7 5%	1/10W
IC103	8-752-340-75	IC CXK1206AM		R214	1-216-049-00	METAL GLAZE 1K 5%	1/10W
IC104	8-752-340-75	IC CXK1206AM		R215	1-216-065-00	METAL GLAZE 4.7K 5%	1/10W
IC105	8-752-340-75	IC CXK1206AM		R216	1-216-055-00	METAL GLAZE 1.8K 5%	1/10W
IC106	8-752-340-75	IC CXK1206AM		R217	1-216-065-00	METAL GLAZE 4.7K 5%	1/10W
IC201	8-759-051-52	IC M51970L		R218	1-216-065-00	METAL GLAZE 4.7K 5%	1/10W
IC202	8-759-600-24	IC M54543L		R219	1-216-029-00	METAL GLAZE 150 5%	1/10W
IC203	8-759-600-24	IC M54543L		R220	1-216-069-00	METAL GLAZE 6.8K 5%	1/10W
IC204	8-759-633-10	IC M54544AL		R301	1-216-061-00	METAL GLAZE 3.3K 5%	1/10W
IC301	8-752-835-67	IC CXP80P116Q-2-203		R302	1-216-037-00	METAL GLAZE 330 5%	1/10W
IC302	8-759-983-69	IC LM358PS		R303	1-216-029-00	METAL GLAZE 150 5%	1/10W
IC303	8-759-925-80	IC SN74HC14NS		R304	1-216-073-00	METAL GLAZE 10K 5%	1/10W
<INDUCTOR>							
L301	1-408-777-00	INDUCTOR CHIP 10UH		R305	1-216-049-00	METAL GLAZE 1K 5%	1/10W
<TRANSISTOR>							
Q201	8-729-901-05	TRANSISTOR DTA124EK		R306	1-216-023-00	METAL GLAZE 82 5%	1/10W
Q202	8-729-901-05	TRANSISTOR DTA124EK		R307	1-216-101-00	METAL GLAZE 150K 5%	1/10W
Q203	8-729-216-22	TRANSISTOR 2SA1162-G		R308	1-216-077-00	METAL GLAZE 15K 5%	1/10W
Q204	8-729-230-49	TRANSISTOR 2SC2712G-YG		R309	1-216-081-00	METAL GLAZE 22K 5%	1/10W
Q205	8-729-101-07	TRANSISTOR 2SB798-DL		R310	1-216-097-00	METAL GLAZE 100K 5%	1/10W
Q206	8-729-140-75	TRANSISTOR 2SD999-CLK		R311	1-216-063-00	METAL GLAZE 3.9K 5%	1/10W
Q207	8-729-140-75	TRANSISTOR 2SD999-CLK		R312	1-216-033-00	METAL GLAZE 220 5%	1/10W
Q301	8-729-901-00	TRANSISTOR DTC124EK		R313	1-216-061-00	METAL GLAZE 3.3K 5%	1/10W
				R314	1-216-057-00	METAL GLAZE 2.2K 5%	1/10W
				R315	1-216-049-00	METAL GLAZE 1K 5%	1/10W
				R316	1-216-037-00	METAL GLAZE 330 5%	1/10W
				R317	1-216-061-00	METAL GLAZE 3.3K 5%	1/10W
				R318	1-216-049-00	METAL GLAZE 1K 5%	1/10W
				R319	1-216-061-00	METAL GLAZE 3.3K 5%	1/10W

MA-15	SE-9	C-18	SU-2	PTC-21	LE-6	S-24
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Ref. No	Part No.	Description				Remark	Ref. No	Part No.	Description				Remark	
R320	1-216-061-00	METAL GLAZE	3.3K	5%	1/10W				<TRANSISTOR>					
R321	1-216-061-00	METAL GLAZE	3.3K	5%	1/10W		Q501	8-719-988-59	PHOTO TRANSISTOR PT501-A					
R322	1-216-061-00	METAL GLAZE	3.3K	5%	1/10W		Q502	8-729-925-97	TRANSISTOR PT421F					
R323	1-216-049-00	METAL GLAZE	1K	5%	1/10W				<RESISTOR>					
R324	1-216-049-00	METAL GLAZE	1K	5%	1/10W		R501	1-216-025-00	METAL GLAZE	100	5%	1/10W		
R325	1-216-033-00	METAL GLAZE	220	5%	1/10W		R502	1-216-025-00	METAL GLAZE	100	5%	1/10W		
R326	1-216-041-00	METAL GLAZE	470	5%	1/10W				*****					
R327	1-216-097-00	METAL GLAZE	100K	5%	1/10W				*1-641-594-11 LE-6 BOARD					
R328	1-216-049-00	METAL GLAZE	1K	5%	1/10W				*****					
R329	1-216-049-00	METAL GLAZE	1K	5%	1/10W				<VARIABLE RESISTOR>					
RV201	1-238-092-11	RES. ADJ CERMET	47K					3-689-205-01	HOLDER (A), LED					
		<SWITCH>							<CONNECTOR>					
S301	1-572-433-31	SWITCH, DIP					CN521	*1-949-470-11	HARNESS (D)					
S302	1-554-303-21	SWITCH, KEY BOARD							<DIODE>					
		<CRYSTAL>					D521	9-910-999-31	DIODE GL-520					
X101	1-567-881-11	VIBRATOR, CRYSTAL							<RESISTOR>					
		*****					R521	1-216-295-00	METAL GLAZE	0	5%	1/10W		
		*1-641-592-11 SE-9 BOARD							*****					
		*****							<DIODE>					
		SUM3 1-690-506-11 CORE, FLAT TYPE (7 CORE)												

		*1-641-595-11 C-18 BOARD						D401	8-719-802-29	DIODE TLC211-GH				
		*****						D402	8-719-800-39	DIODE TLY211				
		<CONNECTOR>						D403	8-719-984-66	DIODE GL420				
		CN511 *1-949-467-11 HARNESS (A)						D404	8-719-801-90	DIODE TL0211				
		<DIODE>							<RESISTOR>					
		D511 8-719-975-18 DIODE GP1S51						R401	1-216-025-00	METAL GLAZE	100	5%	1/10W	
		<RESISTOR>							<SWITCH>					
		R511 1-216-295-00 METAL GLAZE				0		S401	1-554-303-21	SWITCH, KEY BOARD				
		5%				1/10W		SUM1	1-690-505-11	CORE, FLAT TYPE (8 CORE)				

		*1-641-596-11 SU-2 BOARD												

		<CONNECTOR>												
		CN601 1-506-481-11 PIN. CONNECTOR 2P												

		*1-641-593-11 PTC-21 BOARD												

		<CAPACITOR>												
		C501 1-163-038-00 CERAMIC CHIP				0.1MF								
		C502 1-163-038-00 CERAMIC CHIP				0.1MF								
		25V												
		<CONNECTOR>												
		CN501 *1-949-469-11 HARNESS (C)												

Ref. No	Part No.	Description			Remark	Ref. No	Part No.	Description			Remark
	△. *1-413-695-11	SWITCHING REGULATOR(SOP8-1029) *****				C922	1-130-012-00	FILM	330PF	5%	50V
	*A-4915-266-A	AC BOARD, MOUNTED *****				C923	1-126-233-11	ELECT	22MF	20%	50V
	△1-580-375-11	INLET 3P				C924	1-136-169-00	FILM	0.22MF	5%	50V
	△1-949-846-11	HARNESS (1029A)				C925	1-130-481-00	FILM	0.0068MF	10%	50V
	1-543-905-11	CORE, FERRITE						<CONNECTOR>			
		<CAPACITOR>				CN801	△1-560-549-00	V CONNECTOR, BASE PIN 3P			
C851	△1-136-185-00	FILM	0.22MF	20%	250V	CN901	*1-564-241-00	CONNECTOR, (B4P-VH) 4P			
C852	△1-161-742-00	CERAMIC	2200PF	20%	400V	CN902	*1-560-893-00	CONNECTOR, 5P			
C853	△1-161-742-00	CERAMIC	2200PF	20%	400V			<DIODE>			
		<COIL>				D801	△8-719-510-22	DIODE D3SB60			
L851	1-424-614-11	CHOKE COIL	100uH			D802	8-719-928-08	DIODE ERD28-04S			
L852	1-424-614-11	CHOKE COIL	100uH			D803	8-719-313-16	DIODE AU02A			
		<RESISTOR>				D804	8-719-987-87	DIODE ERA85-009			
R851	△1-202-849-00	SOLID	820k	10%	1/2W	D805	8-719-911-19	DIODE 1SS119			
	*A-4915-267-A	M BOARD, MOUNTED *****				D806	8-719-110-49	DIODE RD18ES-T1B2			
	△. *1-949-764-11	HARNESS (1029 ACSW)				D901	8-719-981-44	DIODE ESAD92M-02			
	△. *1-949-764-21	HARNESS (1029 ACSW)				D902	8-719-313-16	DIODE AU02A			
	△. *1-949-764-31	HARNESS (1029 ACSW)				D903	8-719-510-41	DIODE D10SC9M			
	△. *1-949-764-41	HARNESS (1029 ACSW)				D904	8-719-510-41	DIODE D10SC9M			
	△. *1-949-491-11	HARNESS 1028C				D905	8-719-110-02	DIODE RD7.5ESB1			
		<CAPACITOR>				D906	8-719-109-54	DIODE RD2.2ES-T1B2			
C802	△1-136-185-00	FILM	0.22MF	20%	250V	D907	8-719-911-19	DIODE 1SS119			
C803	△1-161-740-00	CERAMIC	470PF	10%	400V	D908	8-719-110-49	DIODE RD18ES-T1B2			
C804	△1-161-740-00	CERAMIC	470PF	10%	400V	D909	8-719-160-71	DIODE RD20FB2			
C805	△1-161-740-00	CERAMIC	470PF	10%	400V	D910	8-719-948-59	DIODE ERB93-02			
C806	1-161-742-00	CERAMIC	2200PF	20%	400V	D911	8-719-911-19	DIODE 1SS119			
		<FUSE>						<FUSE>			
C807	△1-161-742-00	CERAMIC	2200PF	20%	400V	F801	△1-532-203-11	FUSE, 2A			
C808	1-136-165-00	FILM	0.1MF	5%	50V	F802	△1-532-203-11	FUSE, 2A			
C809	△1-125-731-11	ELECT	270MF	20%	400V			<FERRITE BEAD>			
C810	1-162-117-00	CERAMIC	100PF	10%	500V	FB901	1-543-060-00	CORE			
C811	1-162-117-00	CERAMIC	100PF	10%	500V	FB902	1-543-060-00	CORE			
C812	1-126-804-00	ELECT	100MF	20%	50V	FB903	1-543-060-00	CORE			
C813	1-126-803-11	ELECT	47MF	20%	50V	FB904	1-543-060-00	CORE			
C814	1-136-165-00	FILM	0.1MF	5%	50V	FB905	1-543-060-00	CORE			
C815	1-130-479-00	FILM	0.0047MF	5%	50V	FB906	1-543-060-00	CORE			
C901	1-162-318-11	CERAMIC	1000PF	10%	500V	FB907	1-543-060-00	CORE			
C902	1-162-318-11	CERAMIC	1000PF	10%	500V			<IC>			
C903	1-124-602-00	ELECT	2200MF	20%	35V	IC801	△1-809-086-11	HIC CH-1018			
C904	1-124-602-00	ELECT	2200MF	20%	35V	IC901	8-759-520-23	IC FA5304P			
C905	1-126-146-11	ELECT	1000MF	20%	35V	IC902	8-759-908-15	IC TL431CLP			
C906	1-136-173-00	FILM	0.47MF	5%	50V			<COIL>			
C908	1-162-318-11	CERAMIC	1000PF	10%	500V			<COIL>			
C910	1-124-760-11	ELECT	2200MF	20%	10V	L801	△1-424-635-11	LINE FILTER			
C911	1-126-373-11	ELECT	470MF	20%	10V	L802	△1-424-058-11	COIL, LFT			
C912	1-136-173-00	FILM	0.47MF	5%	50V	L803	△1-424-611-11	CHOKE COIL 1500uH			
C914	1-162-318-11	CERAMIC	1000PF	10%	500V	L901	△1-424-255-11	CHOKE COIL 10uH			
C915	1-126-589-11	ELECT	2200MF	20%	16V	L903	△1-424-255-11	CHOKE COIL 10uH			
C916	1-126-316-51	ELECT	470MF	20%	16V	L904	△1-424-255-11	CHOKE COIL 10uH			
C917	1-136-173-00	FILM	0.47MF	5%	50V			<PHOTO COUPLER>			
C918	1-102-228-00	CERAMIC	470PF	10%	500V			<PHOTO COUPLER>			
C919	1-102-228-00	CERAMIC	470PF	10%	500V			<PHOTO COUPLER>			
C920	1-130-483-00	FILM	0.01MF	5%	50V	PH801	△8-719-159-90	PS2652-P			
C921	1-130-493-00	FILM	0.068MF	5%	50V						

The components identified by shading and mark  are critical for safety. Replace only with part number specified.

Ref. No	Part No.	Description			Remark	Ref. No	Part No.	Description			Remark		
<TRANSISTOR>													
Q801	△8-729-926-80	TRANSISTOR	IRFPE40					MISCELLANEOUS			*****		
Q802	8-719-108-30	CYRISTOR	3P4MH					1-543-879-11	HEAD, THERMAL	(KST-100-9MPL14-SN)			
Q901	8-729-321-74	TRANSISTOR	2SK1306					1-551-475-31	CABLE ASSY				
<RESISTOR>													
R801	△1-202-849-00	SOLID	820K	10%	1/2W			1-554-512-00	SWITCH, MICRO				
R802	△1-217-784-11	SEMENT	10	5%	5W			1-690-503-11	WIRE, FLAT TYPE (24CORE)				
R803	1-249-417-11	CARBON	1K	5%	1/4W			*1-949-467-11	HARNESS (A)				
R804	1-260-099-11	CARBON	1K	5%	1/2W			*1-949-468-11	HARNESS (B)				
R805	1-215-904-11	METAL	100K	5%	2W			*1-949-469-11	HARNESS (C)				
R806	1-215-904-11	METAL	100K	5%	2W			*1-949-470-11	HARNESS (D)				
R807	1-247-883-11	CARBON	150K	5%	1/4W			*1-949-471-11	HARNESS (E)				
R808	1-247-883-11	CARBON	150K	5%	1/4W			*1-949-472-11	HARNESS (F)				
R809	1-215-882-00	METAL	22	5%	2W			*1-949-473-12	HARNESS (G)				
R810	1-215-882-00	METAL	22	5%	2W		*****						
R811	△1-217-625-00	METAL PLATE	0.05	10%	2W		ACCESSION & PACKING MATERIALS						
R812	1-249-397-11	CARBON	22	5%	1/4W		*****						
R813	1-249-397-11	CARBON	22	5%	1/4W			*3-173-904-01	CUSHON				
R814	1-249-403-11	CARBON	68	5%	1/4W			*3-176-100-01	INDIVIDUAL CARTON				
R815	1-249-403-11	CARBON	68	5%	1/4W			3-701-630-00	BAG, POLYETHYLENE				
R816	1-247-883-11	CARBON	150K	5%	1/4W			3-754-976-11	MANUAL, INSTRUCTION				
R901	1-215-880-00	METAL	10	5%	2W			1-590-910-11	CORD SET, POWER				
R902	1-249-405-11	CARBON	100	5%	1/4W		*****						
R903	1-205-776-00	SEMENT	470	5%	5W		HARDWARE LIST						
R904	1-215-880-00	METAL	10	5%	2W		*****						
R905	1-215-880-00	METAL	10	5%	2W		<PRECISION>						
R906	1-215-880-00	METAL	10	5%	2W			7-627-556-08	PRECISION +P 2.6 × 2.8				
R907	△1-217-625-00	METAL PLATE	0.05	10%	2W		<SCREW>						
R908	1-249-397-11	CARBON	22	5%	1/4W			7-621-255-55	+P 2 × 8				
R909	1-249-391-11	CARBON	6.8	5%	1/4W			7-628-253-90	+PS 2.6 × 4				
R910	1-249-432-11	CARBON	18K	5%	1/4W			7-682-248-04	+K 3 × 8				
R911	1-249-422-11	CARBON	2.7K	5%	1/4W			7-682-645-04	+PS 3 × 4				
R912	1-249-418-11	CARBON	1.2K	5%	1/4W			7-682-647-09	+PS 3 × 6				
R913	1-249-435-11	CARBON	33K	5%	1/4W			7-682-548-04	+B 3 × 8				
R914	1-249-397-11	CARBON	22	5%	1/4W			7-682-648-01	+PS 3 × 8				
R915	1-249-417-11	CARBON	1K	5%	1/4W			7-682-661-09	+PSW 4 × 8				
R916	1-249-433-11	CARBON	22K	5%	1/4W			7-682-947-01	+PSW 3 × 6				
R917	1-249-424-11	CARBON	3.9K	5%	1/4W			7-682-948-01	+PSW 3 × 8				
R918	1-249-422-11	CARBON	2.7K	5%	1/4W			7-682-949-01	+PSW 3 × 10				
R919	1-249-426-11	CARBON	5.6K	5%	1/4W			7-682-947-04	+BVTT 3 × 6 (S)				
R920	1-249-413-11	CARBON	470	5%	1/4W		<TAPPING>						
R921	1-215-889-00	METAL	330	5%	2W			7-685-546-14	+BTP 3 × 8, TYPE 2, N-S				
R922	1-215-892-11	METAL	1K	5%	2W		<NUT>						
<VARIABLE RESISTOR>													
RV901	1-237-500-21	RES, ADJ	CARBON	1K	FROM(T)B			7-684-023-04	N3, TYPE 2				
RV902	1-228-989-00	RES, ADJ	CARBON	500	FROM(F)B								
RV903	1-241-757-11	RES, ADJ	1K										
<SWITCH>													
SW801	△1-554-880-12	AC PUSH	SWITCH										
<TRANSFORMER>													
T801	△1-450-805-11	CONVERTER	1029A										
T901	△1-450-761-11	CONVERTER	1028B										

The components identified by shading and mark **△** are critical for safety.
Replace only with part number specified.